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1276 MICROFILM

FORWARD

This booklet is not a complete microfilming guide, nor is it intended to be one. Its main objective is to serve as a classroom teaching portfolio and to have it stand as a ready reference for the beginner as well as the seasoned photographer.

Other Microfilming

The Microfilm Camera Operators no matter what their experience level, have a high responsibility placed on them in that each microimage produced must be of optimum quality for two reasons: The first is that the users, whether in-house or public, must have a product that meets their copying and reading needs. The second is that circumstances beyond our control can make the microform the only surviving document we can use to reconstruct a record or to present it before a court of law. In either case, we must have a "true and accurate reproduction", as defined by Federal Law and regulations and is recognized as such in each of the different states so that the "admissibility" of the microform as evidence is not questionable.

Whether you are a manager, photographer, technician or aid, the reference material contained in this booklet will help you to understand the microfilming processes and guide you to higher quality microfilming.

Microfiche (105 mm) Jacketed

Written Record w/CRW Index

Graphic Record



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Denver, CO 80235-0047

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Computer-Integrated Microfilm (CIM)

and Film (CIM or CIMI)

Glossary of Photographic and Photomicrographic Terms

Microscope

Computer-Integrated Microfilm (CIM and

Microfilm in Photomicrography (CIMP Film)

Deep and Shallow

Aperture Stop

Projection Film on Robot Optical Projector

The Magic of Photography

The Dimensions of Light

Properties of Light

The Speed of Light

Transmission of light

Refraction of light

Hot Zones

Reflection

Dispersion

Diffraction of light

Aberration

The Fox Chase

The Nickelodeon

Single Lens

The Telephoto

with which certain areas have been

exposed, leaving others unaffected

in certain

exposure conditions

(baseline) normal

areas coated with

uncoated unexposed and

glassware with which certain areas have been

exposed but uncoated

with uncoated unexposed glassware

dimensions

and uncoated to some extent

coated uncoated

outlines

uncoated layers, with some

with some

uncoated layers, with some?

with some?

out, some?

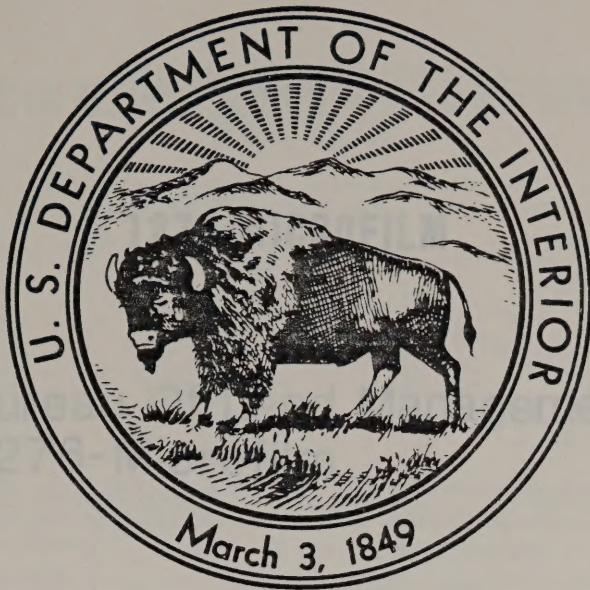
with some? with some?

, so uncoated, uncoated

with some? with some?

uncoated with some?

with some?



Read the Bureau's Department's Manual
Section, 123

01. Purpose. This section of the Manual outlines policy and responsibilities for management of micrographic programs. To proceed, read the Manual!!!

02. Definitions. The six basic applications of microfilm in the Bureau are:

DEPARTMENT OF THE INTERIOR DEPARTMENTAL MANUAL

Information Resources Management Part 385 Office Automation
Technology

Chapter 6 Micrographics Management Program 385 DM 6.1

6.1 Purpose. This directive establishes the Micrographics Management Program; prescribes policy; outlines procedures; and assigns responsibilities for developing, acquiring, and managing micrographics equipment and systems.

6.2 Authority. Federal Property Management Regulation (FPMR) 41 CFR 101-11.5.

6.3 Scope. The policies and guidelines contained in this directive apply to all Department of the Interior offices and bureaus that use or plan to use micrographics equipment or systems.

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1276-MICROFILM

Read the Bureau Of Land Management's Manual Section, 1276-Microfilm.

.01 Purpose. This section of the Manual outlines policy and responsibility for carrying out microfilm operations. It prescribes the administrative process for initiating microfilm projects to insure that they are practical and economical. It also outlines specific microfilm systems as they are developed.

.02 Objectives. The six basic applications of microfilming in the Bureau are:

- Reduction of Space
- Security
- Preservation
- Reproduction and Distribution
- Information Retrieval
- Improved Administrative Procedures

.03 Authority.

A. Federal Records Act of July 7, 1943, as amended.

B. 41 CFR 101-11.5.

.04 Responsibility

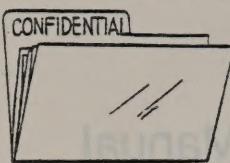
A. Washington Office. The Chief, Branch of Records Management, in the Division of Information Resource Management (870) is responsible for the Bureau's micrographic policy and program; approval of all new application proposals, systems, projects, and related micrographic equipment purchases; and providing the lead for technical assistance outside the realm of approved systems and projects.

B. Service Center. The Asst. Service Center Director, Data Systems (D-200), has the responsibility as assigned by the Washington Office for performing feasibility studies; the design, development, and review of micrographic systems; establishing and controlling technical standards; providing technical training; and furnishing technical advice, assistance, and microphotographic services for approved systems and projects to Field Offices on request.



BENEFITS OF A GOOD MICROFILM SYSTEM

Speeds the flow of new information from source to need.

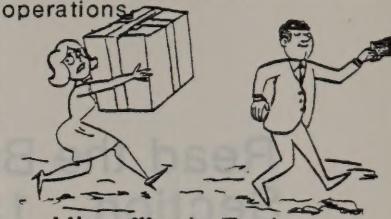


Information Control

Large paper files are eliminated.



Good indexes, retrieval systems, and microimages produce more efficient operations.



Microfilm is Easier to Use than Paper



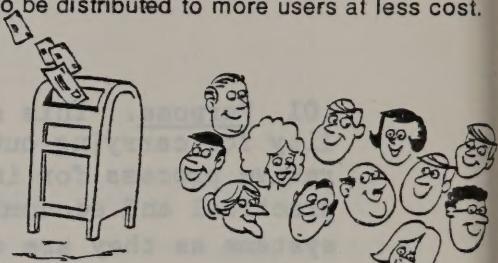
Microfilm Saves Time

Separate documents cannot be misfiled, lost, or removed.



File Integrity

Image packing density allows more information to be distributed to more users at less cost.



Distribution

A good microfilm system is an efficient information management tool.



A Better End Product



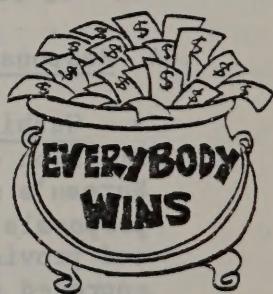
Security



94 to 96 % Savings



More Space



With Good Microfilm

ARCHIVAL MICROFILM

What Is It?



Archival microfilm serves two purposes:

1. It provides for the perpetuity of permanent records.
2. It provides security backup for permanent records.

The National Archives Records Services (NARS) has the responsibility of providing the rules, regulations, and standards for the production of archival microfilm by other Government Agencies. Information developed by the National Bureau of Standards, The U.S. Military Services, The American National Standards Institute (ANSI), The Association for Information and Image Management (AIIM), (formerly The National Micrographics Association, (NMA)), and others is used by NARS in standards, etc. for:

Microfilming of permanent records

Types of materials and production equipment to be used

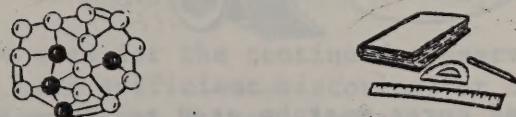
Chemical processes and tests to be used

Production and quality standards

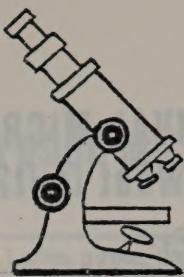
Proper storage conditions



Many field office users have the misconception that the high quality optics (lens systems) provided in most microfilm cameras constitute the only necessity in producing archival microfilm. The camera is but one step in an involved process of producing archivable microfilm.



Standards for the manufacture of archival microfilm require that they be chemically and dimensionally stable. Tolerances are also prescribed for base material strength, width, thickness, and transparency.



Silver halide films that meet the required standards are proven to be the most acceptable film type for archiving. Silver halide coatings must be able to resolve a minimum of 110 lines per millimeter at a 16 x reduction. See page 50 for Standard Test Target.

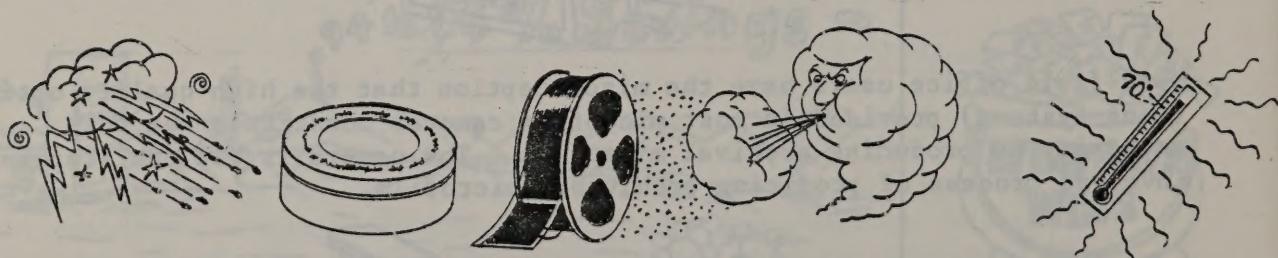
Proper background densities will insure a quality reproduction if ever a microfilm must be called up to reconstruct a destroyed document or file because of a disaster. 41 CFR 101-11.5-6-3

RECOMMENDED BACKGROUND DENSITIES.

Classification	Description of documents	Back-ground density
Group 1.....	High-quality printed books, periodicals, and dense typing.....	1.30-1.50
Group 2.....	Fine-line originals, letters typed with a worn ribbon, pencil writing with a soft lead, and documents with small printing.	1.15-1.40
Group 3.....	Pencil drawings, faded printing, graph paper with pale, fine colored lines, and very small printing such as footnotes.	1.00-1.20
Group 4.....	Very weak pencil manuscripts and drawings, and poorly printed, faint documents.	0.90-1.10
Group 5.....	COM	1.50-2.00



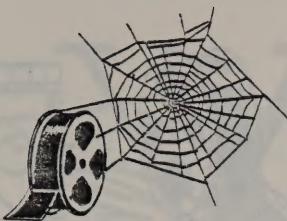
Precise chemical processing and testing for residual chemicals left on the film is a requirement of archivability.



Correct containers and cores must be used to store archival microfilms in an environment where relative humidity ranges between 20%-40% (optimum 30%) and temperature is kept below 70 degrees Fahrenheit with less than a 5% change in any 24-hour period. Films must be protected from dust and airborne gasses.

Handle all original microfilms while wearing clean, film-handling gloves.

ARCHIVAL RECORDS



The master microform shall not be used for reference purposes. Duplicates shall be used for references and for further duplication. 41 CFR 101-11.508



Silver halide film to be classed as "Archival" must meet the following requirements and standards:

41 Code of Federal Regulations (CFR) subpart 101-11.5 Micrographics Federal Standard 125D, Film, Photographic and Film, Photographic Processed (for Permanent records use)

American National Standards Institute (ANSI)

ANSI PH1.25-1976, Safety Photographic Film, Specifications for;

ANSI PH1.28-1976, Photographic Film for Archival Records, Silver Gelatin Type on Cellulose Ester Base, Specifications for;

ANSI PH1.41-1976, Photographic Film for Archival Records, Silver Gelatin Type on Polyester Base, Specifications for;

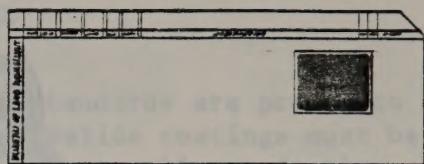
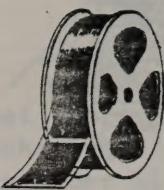
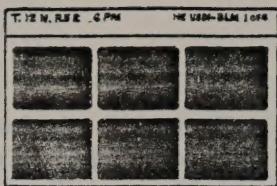
ANSI PH4.8-1978, Methylene Blue Method for Measuring Thiosulfate and Silver Denitometric Method for Measuring Residual Chemicals in Films, Plates and Papers;

ANSI PH1.43-1981, Storage of Processed Safety Photographic Film Practices for.

NOTES: ANSI standards are periodically updated; use the most recent version.

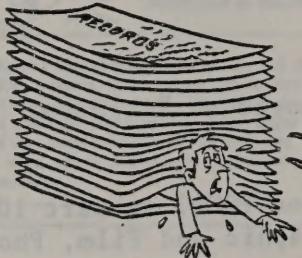
Microfilms intended to be used for the continued preservation of permanent Government records, that have sufficient historical or other value as determined by the Archivist of the United States, are required to be produced under the regulations prescribed for "Archival Microfilm."

OTHER MICROFILMING



Silver
acetate
resolve
to do

An office that retains the original records in accordance with the approved records disposition schedule may apply BLM standards and requirements for the creation of microforms of the records to fulfill Bureau operational needs. (See 41 CFR-11.506.2c). Microfilms of this type are not regulated by archival standards except for quality and production standards (film, chemistry, resolution, density, and inspection). Applicable standards also apply to other microfilms.



Authorized Bureau microfilming systems have effectively reduced paper volumes once maintained in BLM offices.

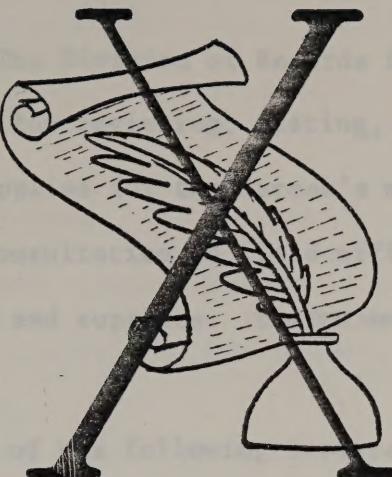


Even though these microfilms are not archival, they continually provide an up-to-date security backup in case of disaster.

Temperature to microfilm storage has not been set at absolute uniformity since radio to localized sensitivities and heat sources vary. Records are to be stored in a temperature-controlled environment. Microfilm environments where temperatures fluctuate more than +10 degrees Fahrenheit with more than a 5% change in any 24-hour period. Film must be protected from dust and ultraviolet rays.

Handle all original microfilm while wearing clean, film-handling gloves.

EQUIPMENT AND SUPPLIES



1. Equipment and Supplies. The Denver Service Center has the responsibility for procuring, evaluating, and recommending equipment and supplies for the micrographics program and for providing assistance and consultation on the use of contemporary and emerging equipment, procedures and systems. Denver Service Center will utilize:

A. Considerations. Each of the following factors are considered and evaluated to determine the most suitable source of equipment and supply selection:

Direct enhancement of legal documents is not to be performed.

Enhancement of legal documents as well as old, faded, or low contrast documents can often be obtained through office machine copy techniques. However, if the machine copy is manually "touched up" it cannot be certified as a "true-copy of the original". Any transcribed, refurbished, or touched-up copy of an original legal document must include a notation to that effect before being microfilmed.

EXAMPLE STATEMENTS:

"TRANSCRIBED COPY OF THE ORIGINAL FIELD NOTES"

"REFURBISHED COPY OF THE ORIGINAL DOCUMENT"

"TOUCHED-UP COPY OF THE ORIGINAL DOCUMENT"

possible between anticipated needs for equipment, supplies and systems.

Inadequate consideration of this factor could result in unforeseen obsolescence, costly replacement, and under-utilization of equipment and supplies.

EQUIPMENT AND SUPPLIES

1. Equipment and Supplies. The Division of Records Systems, Denver Service Center has the responsibility for reviewing, testing, evaluating, and recommending equipment and supplies for the Bureau's micrographics program and for providing expertise and consultation to field offices on contemporary and emerging equipment, processes and supplies. (See BLM Manual Sections 1216 and 1276.)

A. Considerations. Each of the following factors are considered and evaluated to determine their overall impact of specific equipment and supply selection:

Compatibility

Versatility

User requirements

Service and repair

Obsolescence

Cost

Utilization

Current and planned systems

Technical quality and reliability.

1. Compatibility. Provide and perpetuate the greatest compatibility possible between existing and planned equipment, supplies and systems.

Inadequate consideration of this factor could result in unforeseen obsolescence, costly single use, and under-utilization of equipment and supplies.

2. Versatility. Obtain versatile equipment and supplies to promote the goals of other consideration factors, reduce space requirements and increase operator efficiency without sacrificing quality or other requirements.

3. User requirements. Consider items such as simplicity of operation, hard copy print durability (particularly for field operations or public sale), operator fatigue, print size and magnification power, and system data or information use.

4. Service and repair. This factor relates to the type of equipment being selected, the frequency and probability of service or repair, and the availability of such service. Normal maintenance, cleaning, and bulb replacement on a simple viewer requires minimal consideration. However, service and repair availability are of maximum importance for cameras and reading-printing equipment.

5. Obsolescence. Research the possibility of the item being discontinued or replaced in the near future, service and parts availability if discontinued, introduction of prototype replacements, and emerging technology.

6. Cost. Perform a cost-benefit analysis and comparison of like products of various manufacture and capability. The cost-benefit analysis should include many of the related considerations outlined herein.

7. Utilization. Where the rental time cost exceeds purchase cost and contract turn-around time can become excessive, confirm the irrefutable in-house need including any intermittent use to preclude rental of equipment, contract services, or Microfilm Project services.

8. Current and planned systems. Consider the specifications, microforms and equipment of operational and planned systems to provide for versatility and the broadest compatibility possible. Exclusive single use equipment or supplies are rarely justifiable.

CAMERA TYPES

9. Technical quality and reliability. Conduct performance tests and evaluations of equipment and supplies to determine their ability to consistently meet performance, quality, and user requirements.



TYPE: Planetary Camera
FEATURES: Variable reductions
35mm or 16mm Roll Film

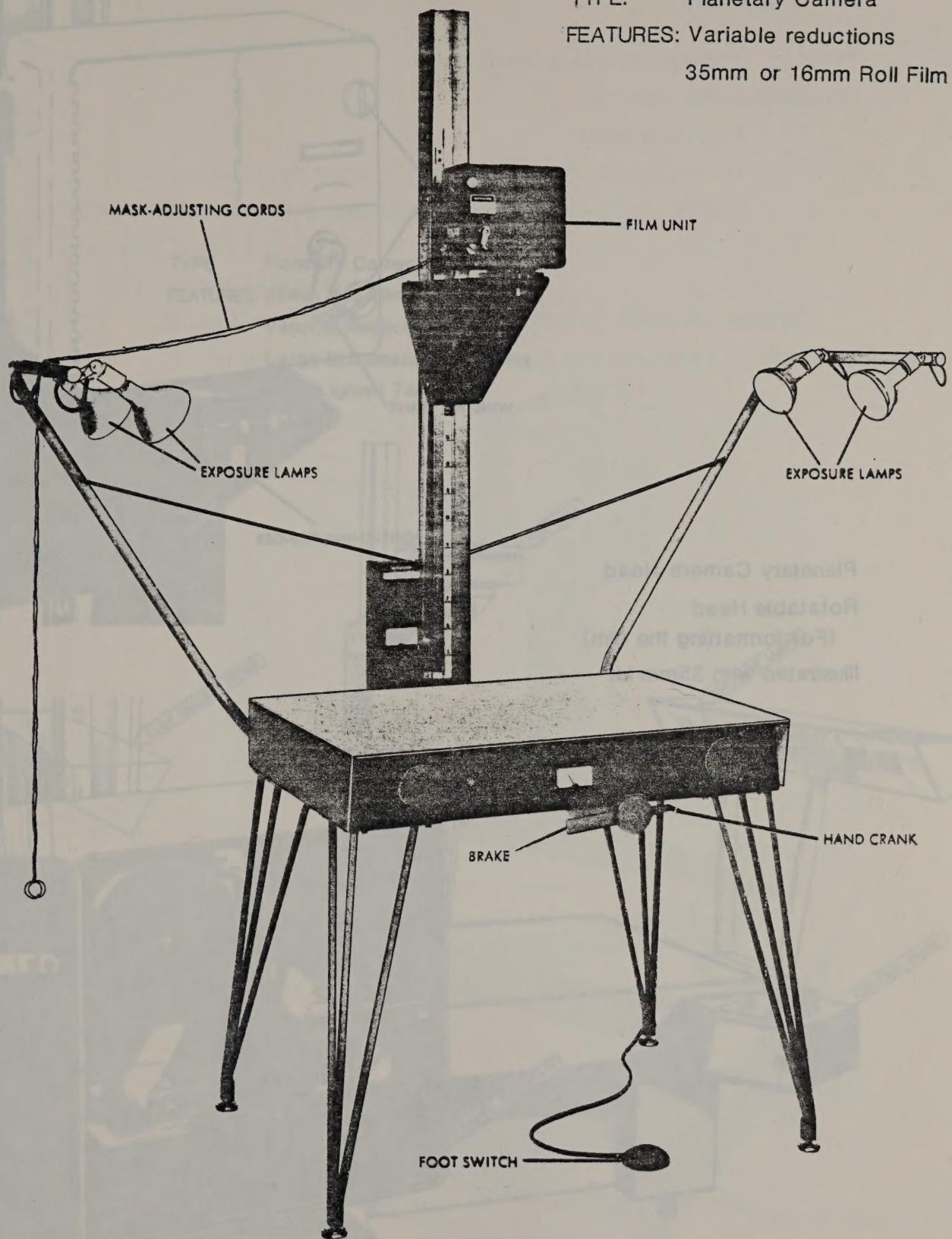
CAMERA TYPES

The following illustrations are representative of different micrographic camera types. Each design is utilized for application to specific user and equipment requirements.

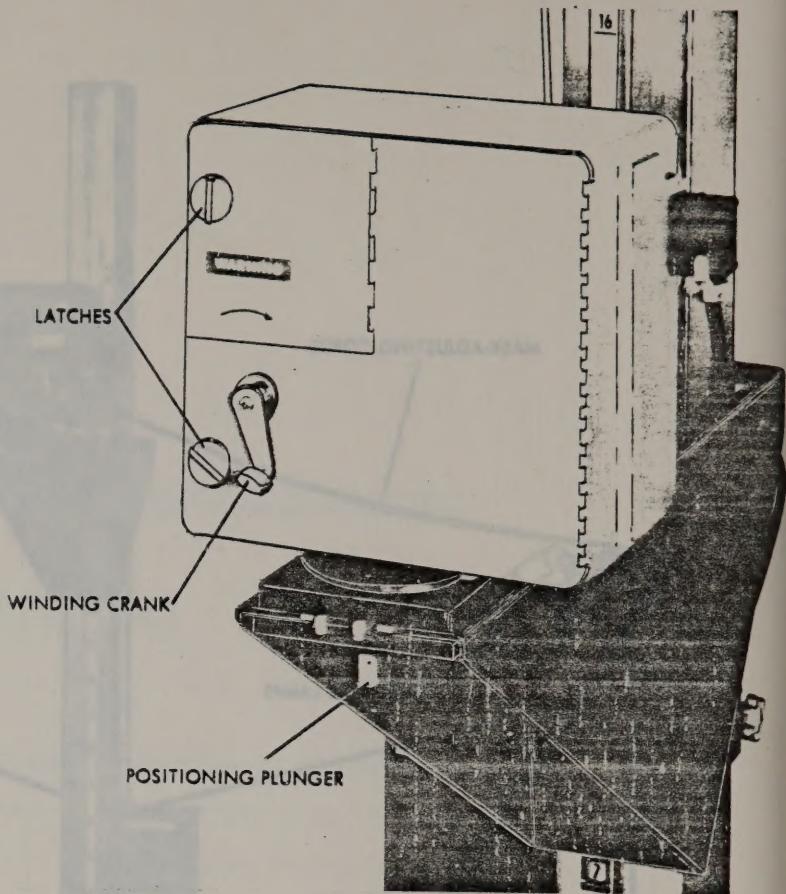
TYPE: Planetary Camera

FEATURES: Variable reductions

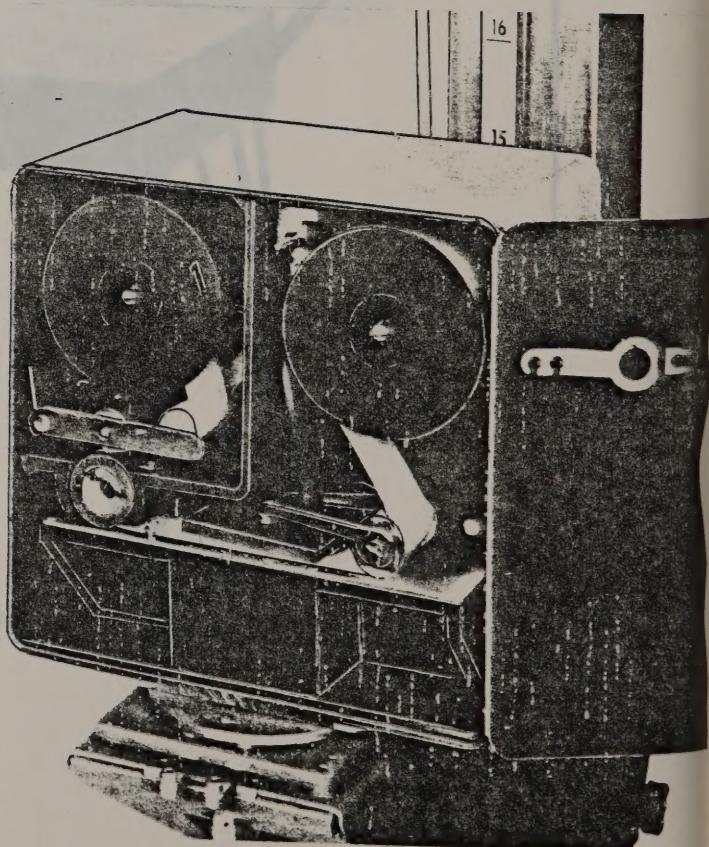
35mm or 16mm Roll Film



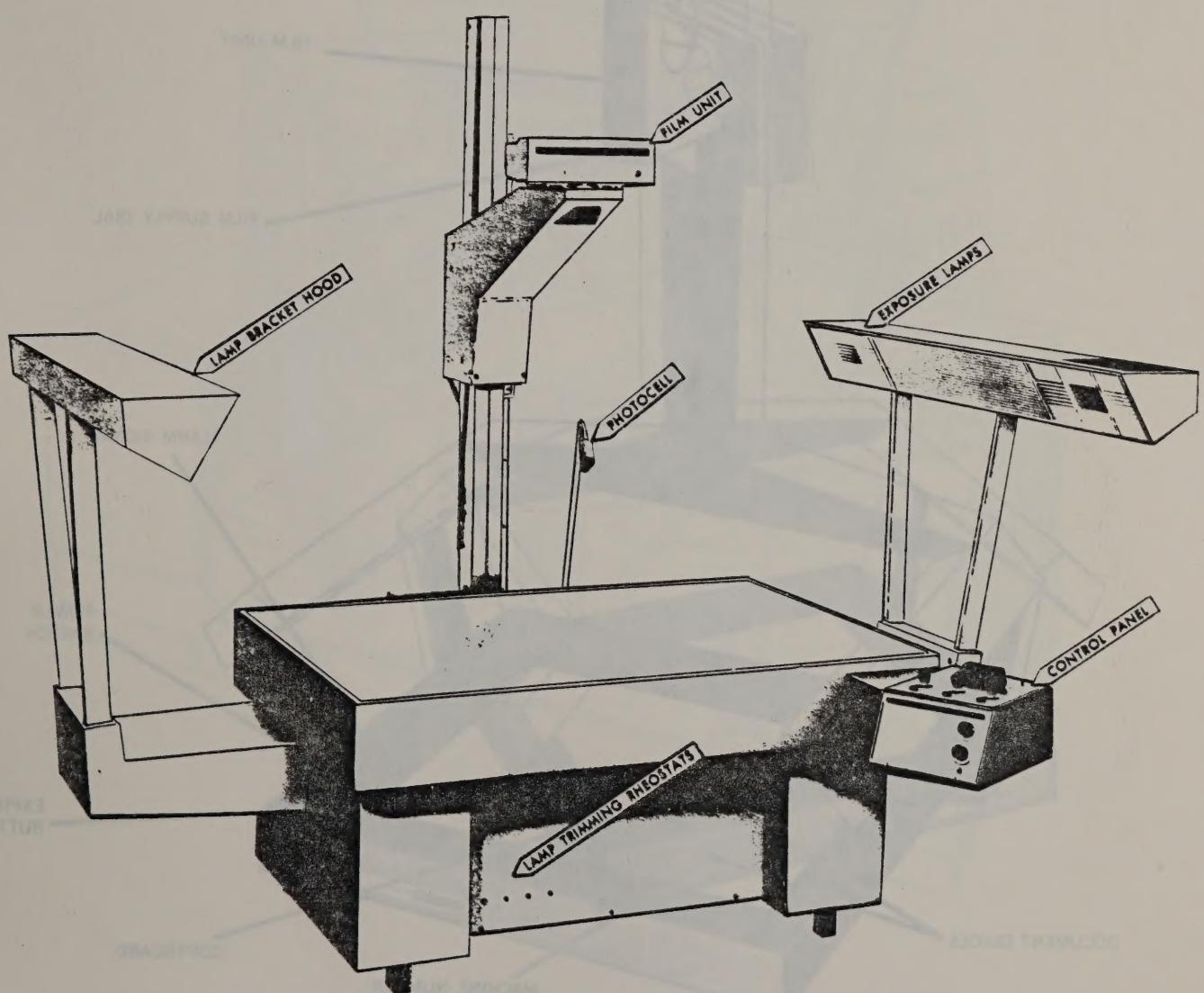
TYPE 35mm Camera
FEATURES: Automatic Advancement
Square or 16mm Roll Film



Planetary Camera Head
Rotatable Head
(For formatting the film)
Illustrated with 35mm kit



TRY
Pentacon Camera (Optional)
FEATURES: 35mm Roll Film
Fixed Resolution
Fixed Camera Head Position for small documents
TYPE: Chromatic Microfilm Camera
FEATURES: Large Document
TYPE: Planetary Camera
FEATURES: 35mm Roll Film
Dual CH Variable Reductions
Fixed Head Large Document Capabilities
Back-Lighted Table



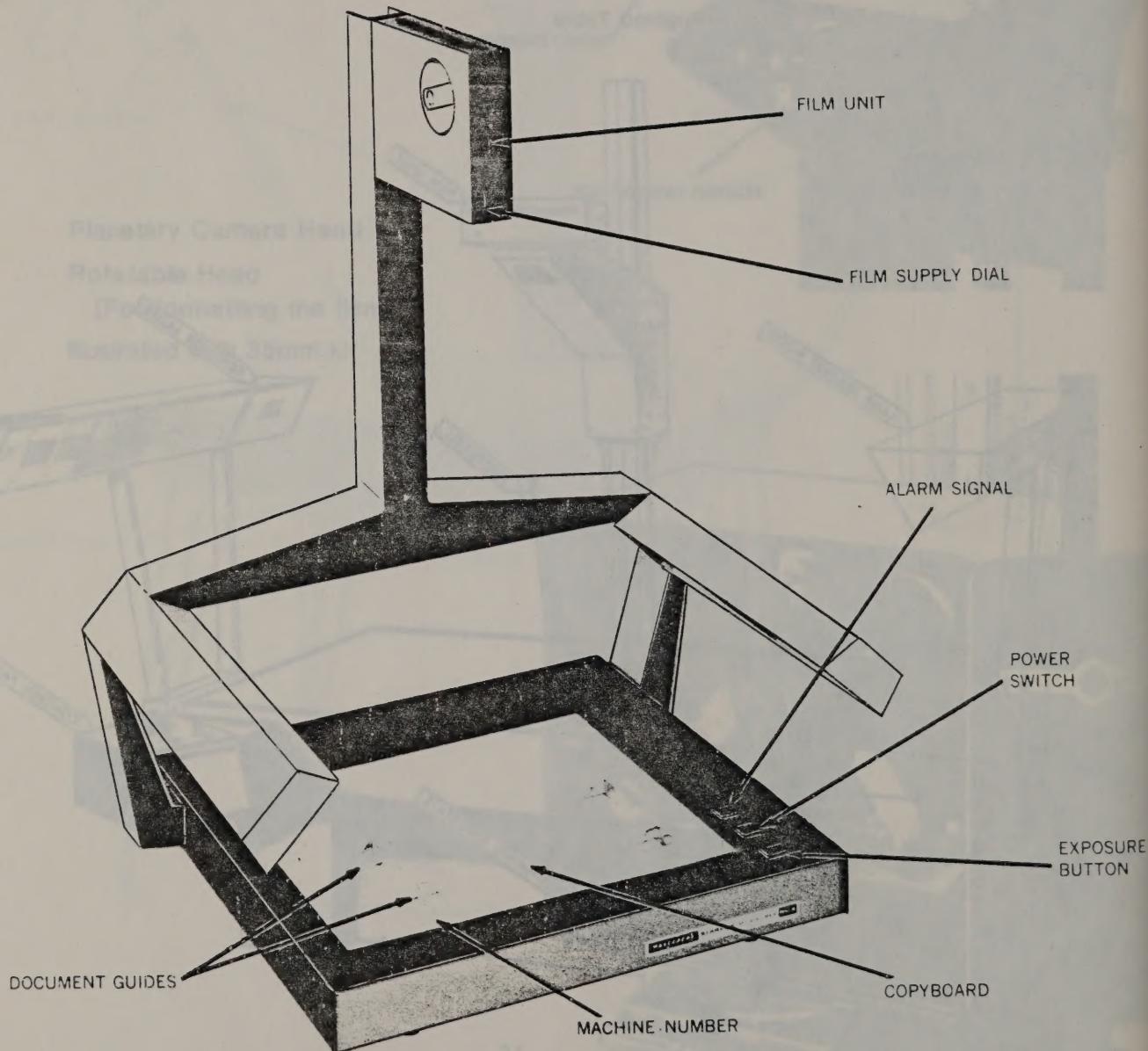
TYPE: Planetary Camera (Portable)

FEATURES: 16mm Roll Film

Fixed Reduction

Fixed Camera Head Position (for small documents)

(Formatting is accomplished by document rotation.)



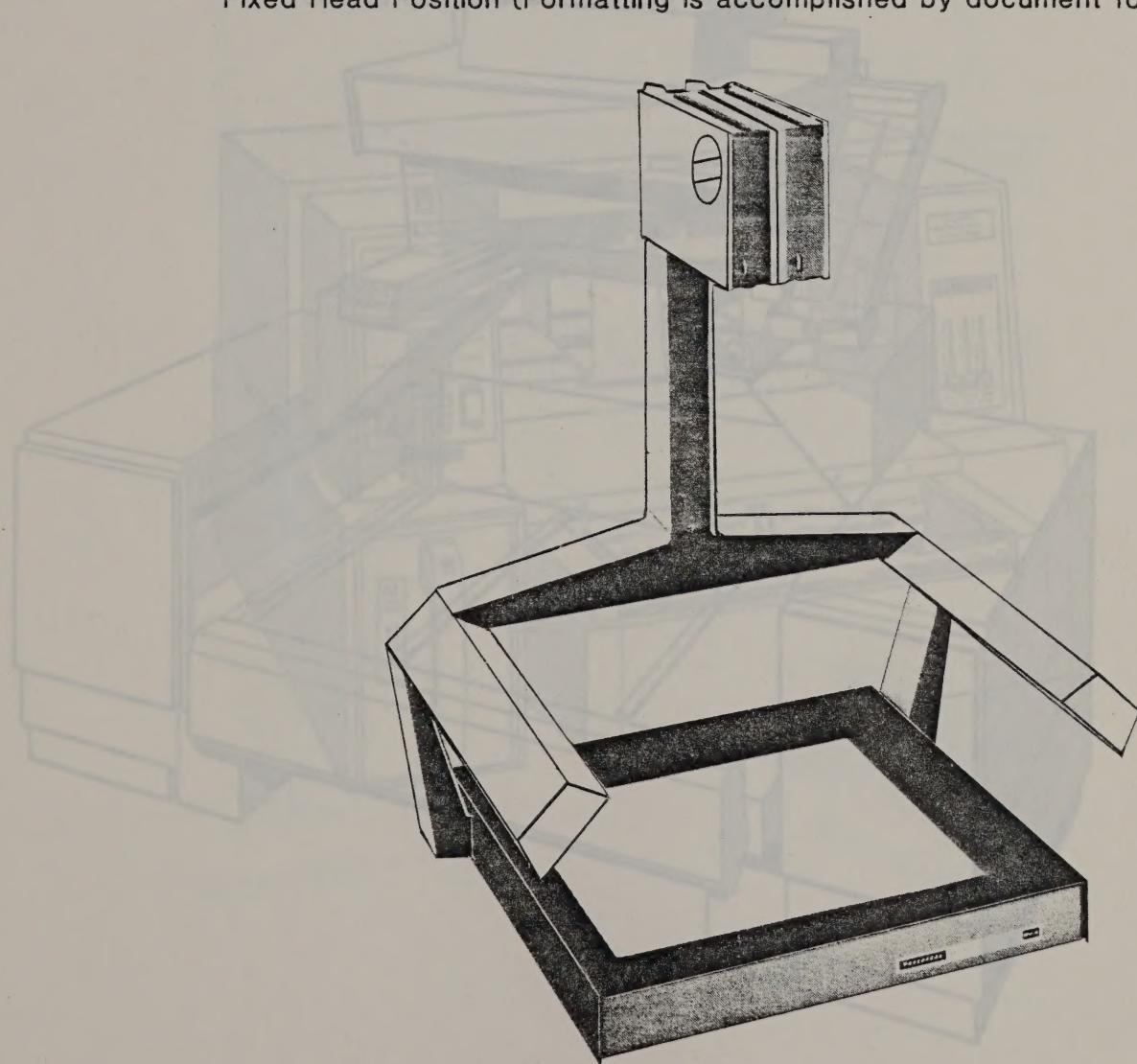
TYPE: Planetary Camera (Portable)

FEATURES: 16mm Roll Film

Fixed Reduction Film

Dual Camera Heads (Security filming of small documents)

Fixed Head Position (Formatting is accomplished by document rotation.)



TYPE: Planetary Camera (Pomona)

FEATURES: 16mm Roll Film

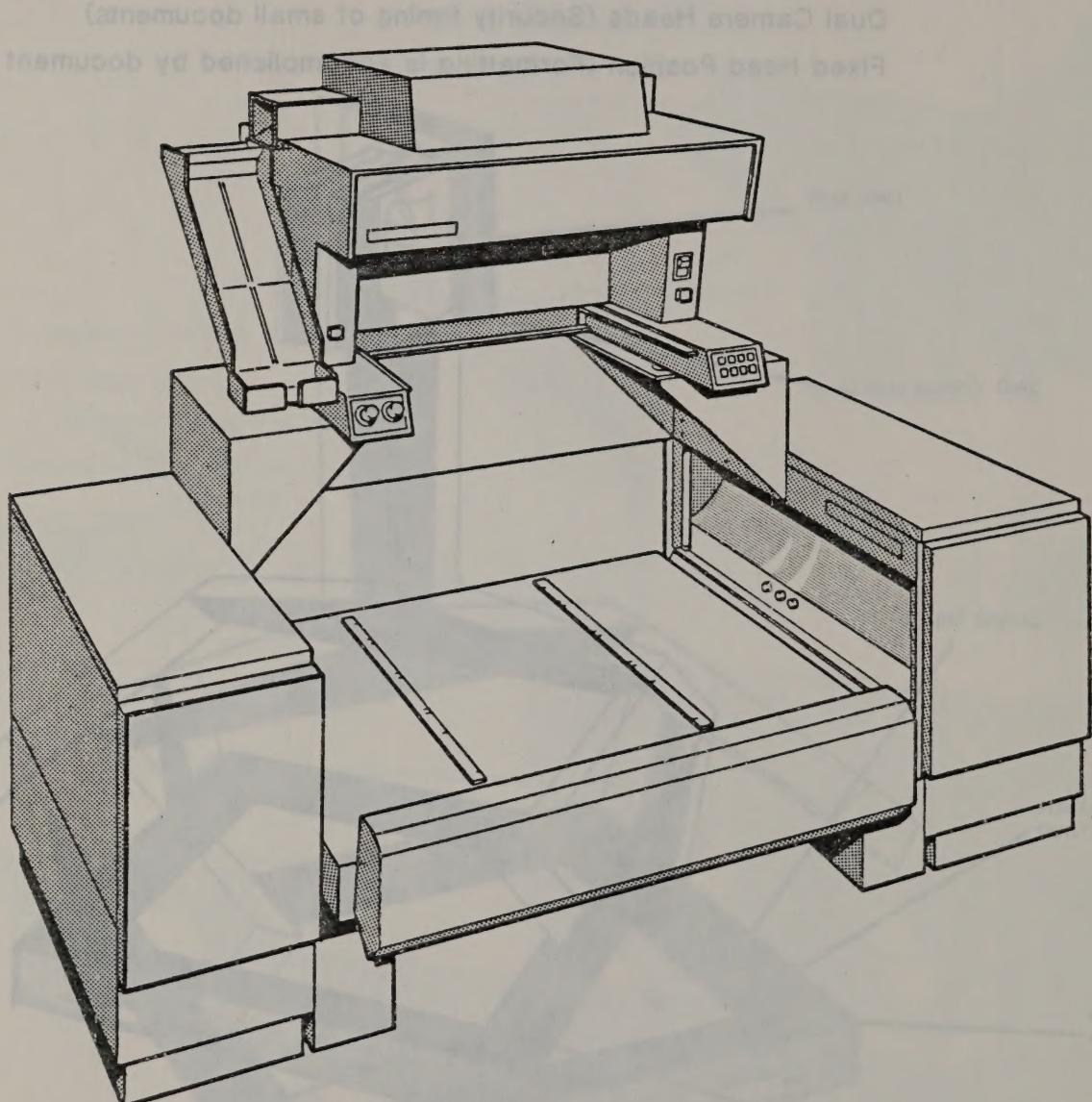
Fixed Reduction

TYPE: Planetary Camera/Processor

FEATURES: 35mm Aperture Cards

Variable Reductions

Back Lighted Table

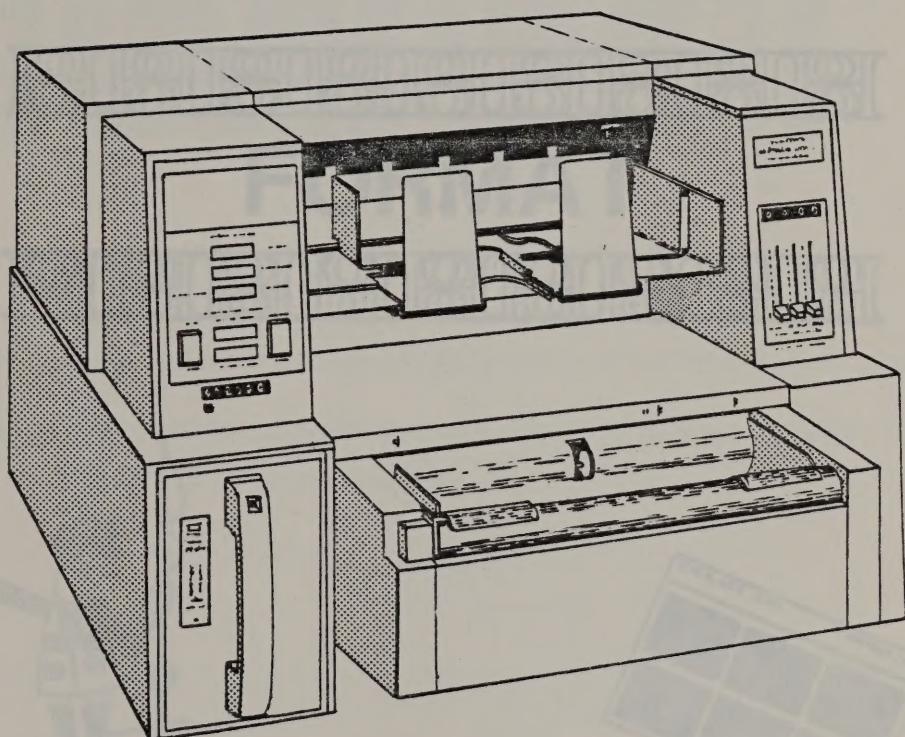


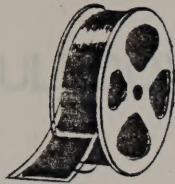
TYPE: Rotary Camera

FEATURES: 16mm Roll Film

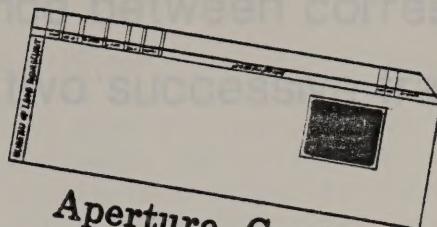
High Speed

One Or Both Sides Document Filming





Roll Film



Aperture Cards



FORMAT



- * Pulldown is important to systems using photo-optical coding on roll film.
- * The amount of pulldown we determine the number of names one chamber allowed in a tracking system.



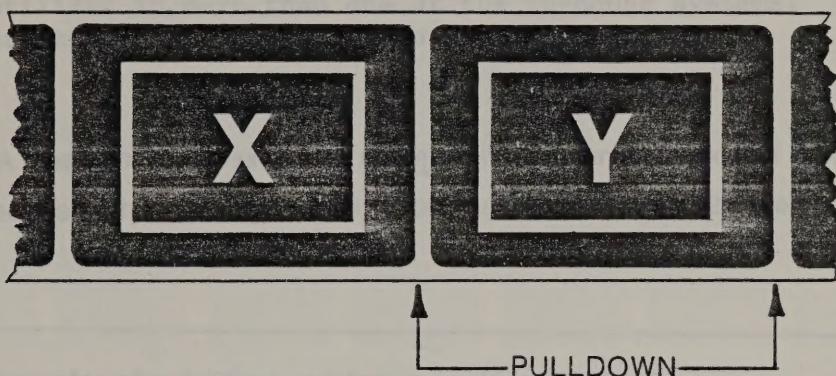
Micro-fish



Microfiche

1276 MICROFILM Microfilm Formatting

PULLDOWN: The distance between corresponding points on two successive frames.



1276

Examples of reductions and formats

- Pulldown is important to systems using photo-optical coding on roll film.
- The amount of pulldown will determine the number of frames per chamber allowed in a jacketing system.

NOTE: Do not confuse "lines per packing density", (the number of images per microfiche) with "density of the image", (the intensity of the light absorbing portion of the film image).

MICROFICHE (105mm) Jacketed Roll Film—Systemized Records

1276 MICROFILM Microfilm Formatting

Since the early 1960's the microform industry has taken great strides in new technologies that offer producer/users a wide variety of photomechanisms in cameras, films, and processes. In many instances the new products feature an advancement or change in formatting. The changes may be for the better, but may also be totally foreign to existing systems and therefore undesirable for unification with them. In other cases, the photomechanics may be versatile enough to be utilized in more than one of the in-house systems. This section provides illustrations of formats now in use.

REDUCTION—A measure of the number of times a given linear dimension of a document is reduced when photographed, expressed as 16X, 20X, 24X, etc.

1276

Examples of reductions and image packing density.



20X Reduction



24X Reduction



42X Reduction



48X Reduction

NOTE: Do not confuse "image packing density", (the number of images per microform) with "density of the image", (the intensity of the light absorbing portion of the film image).

FORMATS

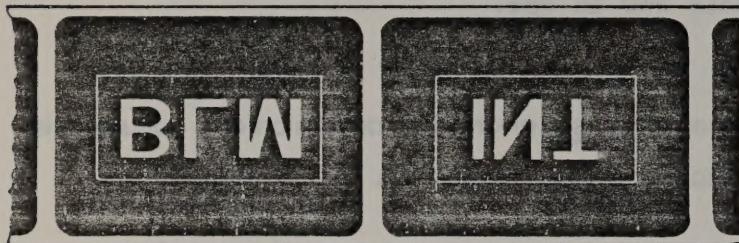
Image Orientation

Considerations for formatting microfilm

COMPATIBILITY: Format must be compatible with existing retrieval systems and reading/reproduction equipment.

USER REQUIREMENTS: Image blow-back on reader screens and hard copy-prints should be at or very near the original size so data is as readable as the source document.

UTILIZATION: Orientation is selected for use in roll, fiche, or card formats.



← Leading end of film (35mm)

"B" Orientation or Comic Mode

Original Image (Emulsion on reverse reading side)



Comic-oriented images are positioned on microfilm in the same orientation as the frames of a comic strip.



← Leading end of film (35mm)

"A" Orientation or Ciné Mode

Original Image (Emulsion on reverse reading side)



Cine-oriented images are placed on microfilm in the same mode orientation as the frames on movie film. Note the difference of the reduction ratios and mask or curtain opening (only on cameras so equipped) required to film the same original document in either the comic or ciné modes.

SIMPLEX FORMAT

(One strip or row of images on roll film)

Illustrations are shown of film as it is unreeled from the developed roll.

MICROFICHE (105mm)

Jacketed Roll Film—Systemized Records

Written Record with COM Index (16mm Jacket)

From 16mm silver halide roll film—COM film—24X reduction—Reduction ratio is variable to obtain uniform blow-back from written record film: comic mode

T 10 N R 1 W PM

MT USDI-BLM 1 OF 5



VOLUME

R 15

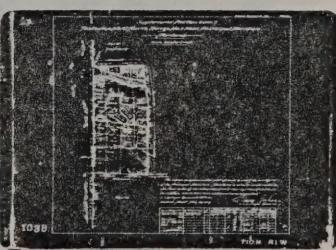
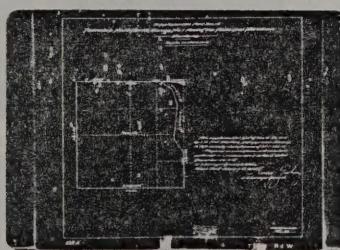
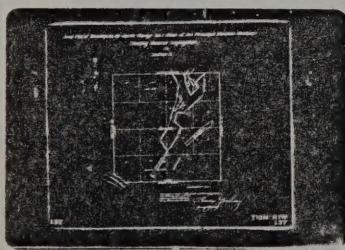
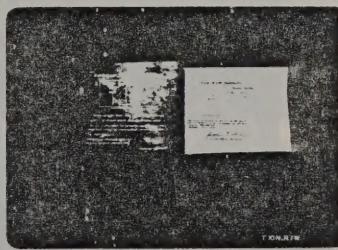
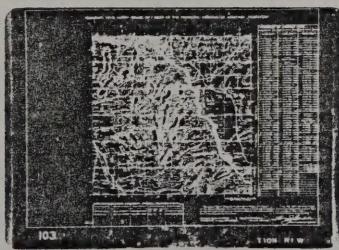
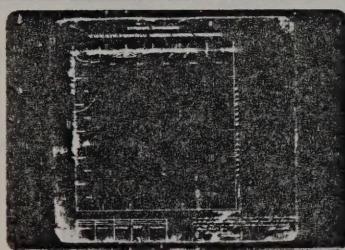


Graphic Record (35mm Jacket)

From 35mm silver halide roll film —14 1/2X to 16X reduction: comic mode

T 10 N R 1 W PM

MT USDI-BLM 1 OF 3-



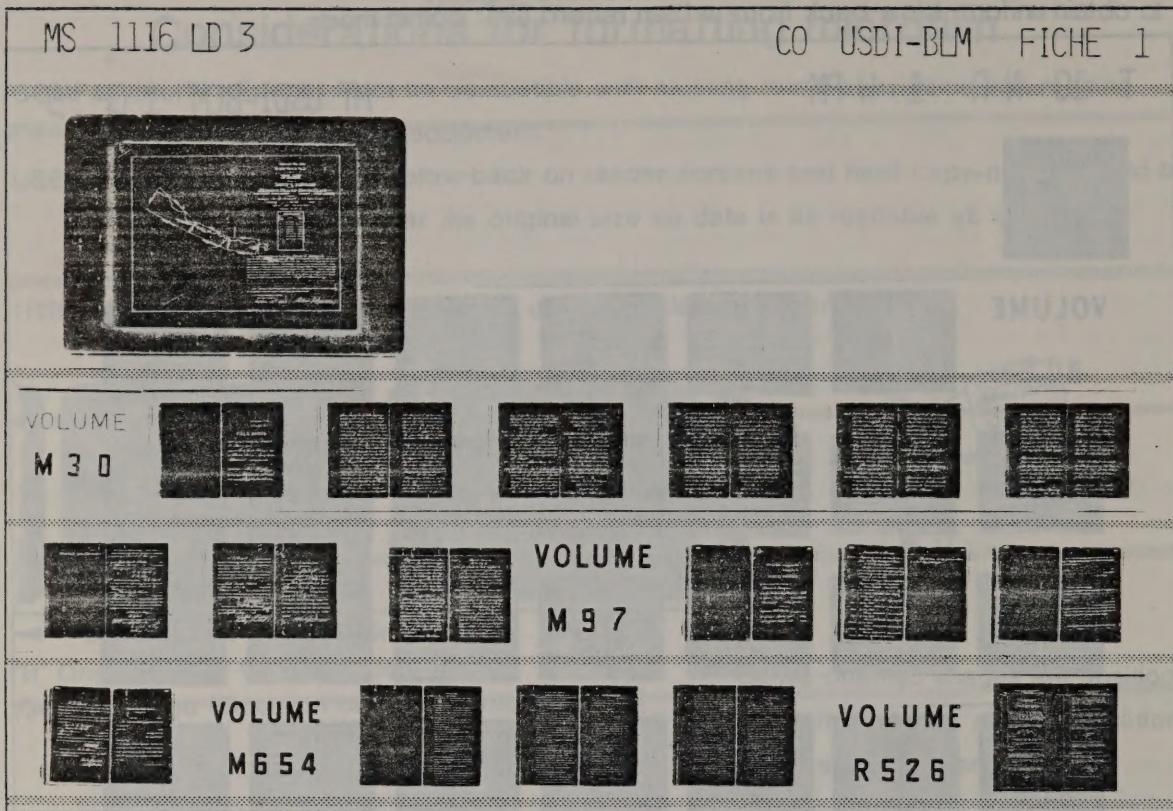
MICROFICHE (105mm)

Jacketed Roll Film- Systemized Records

Graphic And Written Record (35mm/16mm Combination Jacket)

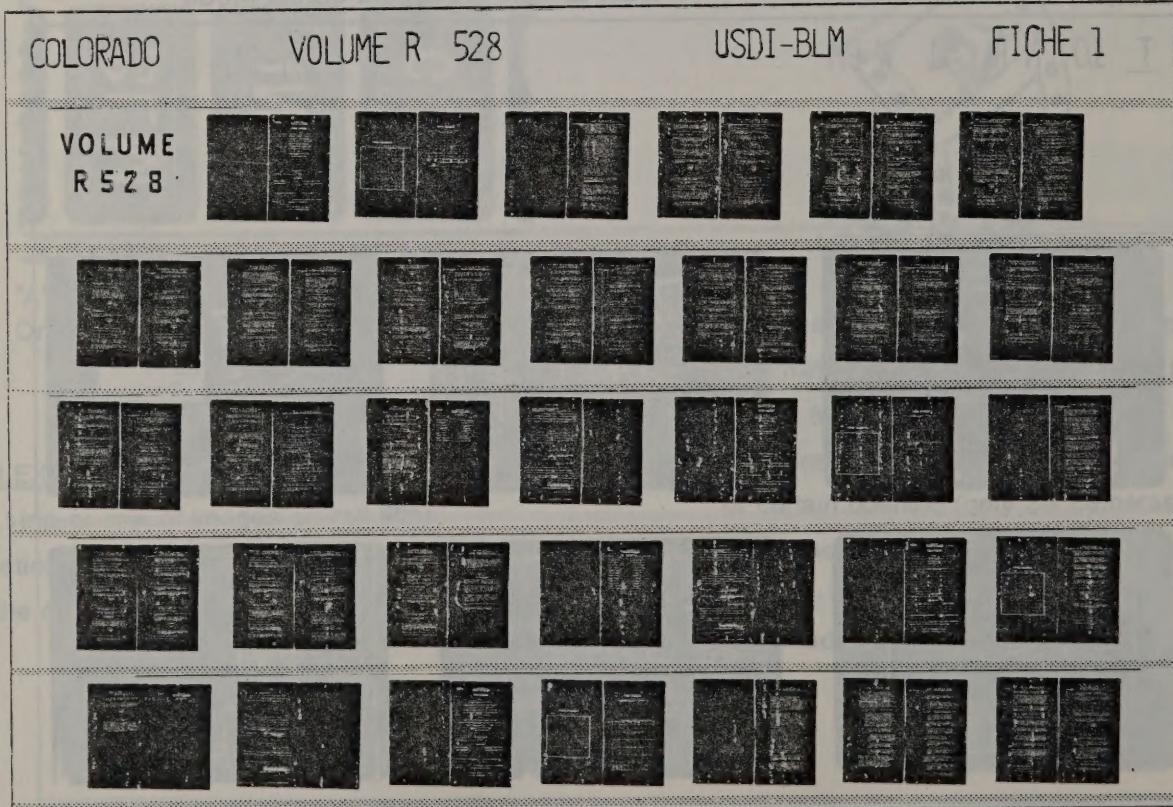
From 35mm and 16mm silver halide roll film—35mm film-14 1/2X to 16X reduction—

16mm film—Reduction ratio is variable to obtain uniform blow-back:comic mode



Straight Through Filming System And Update Format (16mm Jacket)

From 16mm silver halide roll film—Reduction ratio is variable to obtain uniform blow-back: comic mode



COMPUTOR OUTPUT MICROFILM (COM Film)

Index and Program

COM Film (16mm)

From 16mm silver halide roll film—24X reduction: comic mode



UPDATABLE FILM

Translucent ElectrophotoGraphic Film (TEP Film)

Cut sheet (folded) 105mm Km—25X reduction (minimum resolution 200 lines/mm)

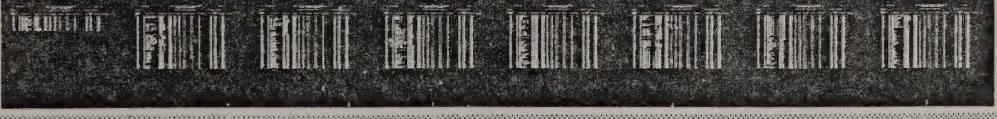
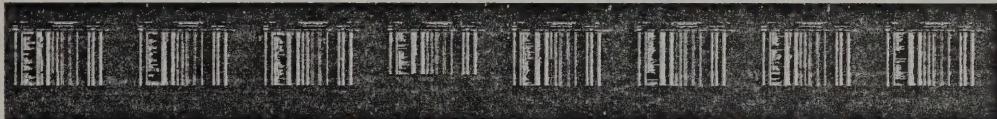
Atom photoconductive film—25X reduction (minimum resolution 200 lines/mm)

MICROFICHE (105mm)

COM Film (16mm Jacket)

From 16mm silver halide roll film—24X reduction: comic mode

MINERAL SURVEY NUMBER INDEX 489 THRU 868 OR USDI-BLM



MICROFICHE (105mm)

Jacketed Roll Film- Systemized Records

Graphics And Written Material Most Appropriate To Film Reduction

From 35mm and larger silver halide roll film—35mm film-24 reduction to 105mm film

16mm film—Reduction ratio 16:1—24 reduction to 105mm film

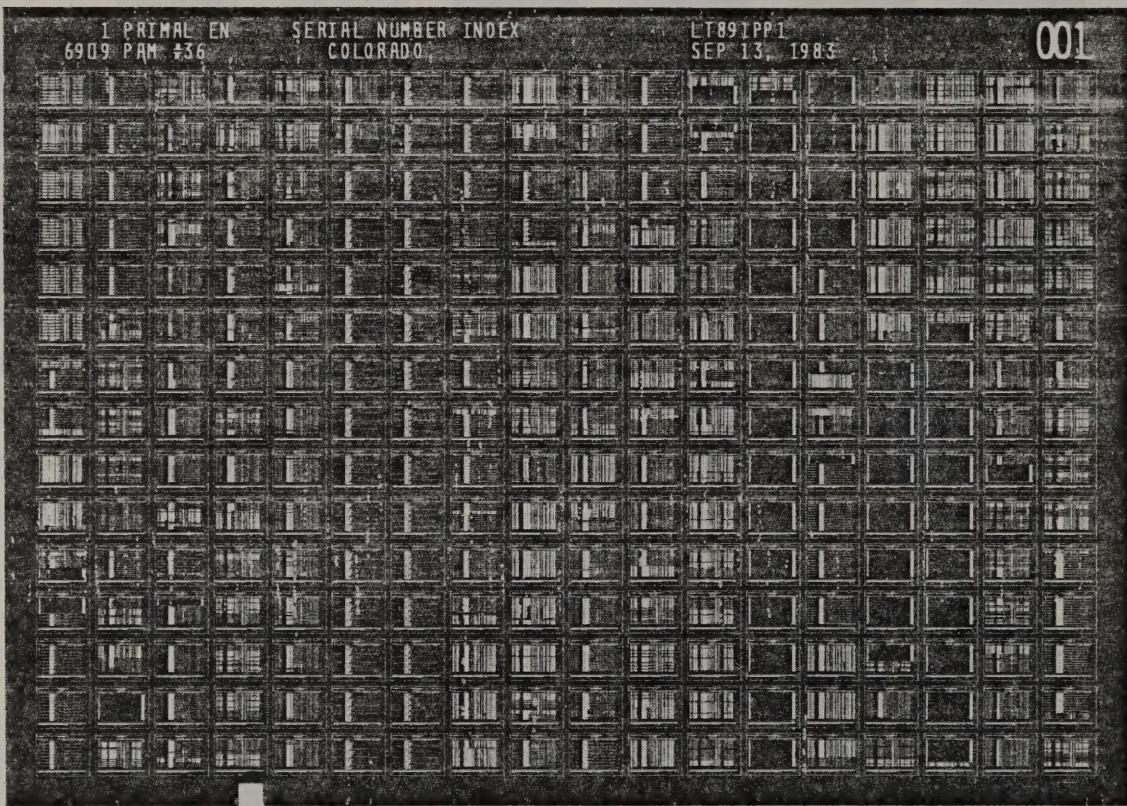
MICROFICHE (105mm)

PC 105mm 3

PC 105mm 4

Computer Output Microfilm (105mm)

From 105mm silver halide roll film—42X reduction: comic mode



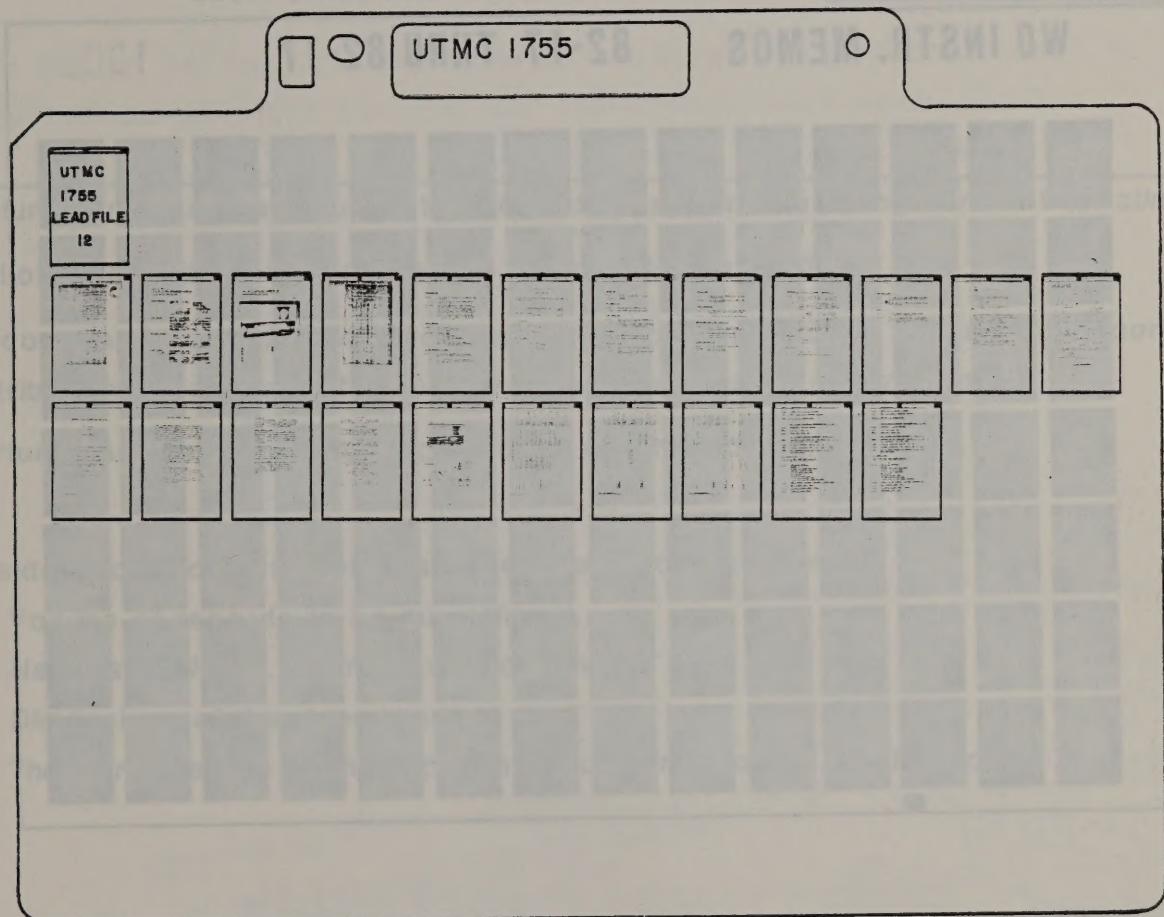
APERTURE CARDS
105mm MICROFICHE

MICROFICHE (105mm)

UPDATABLE FILM

Transparent Electrophotographic Film (TEP Film)

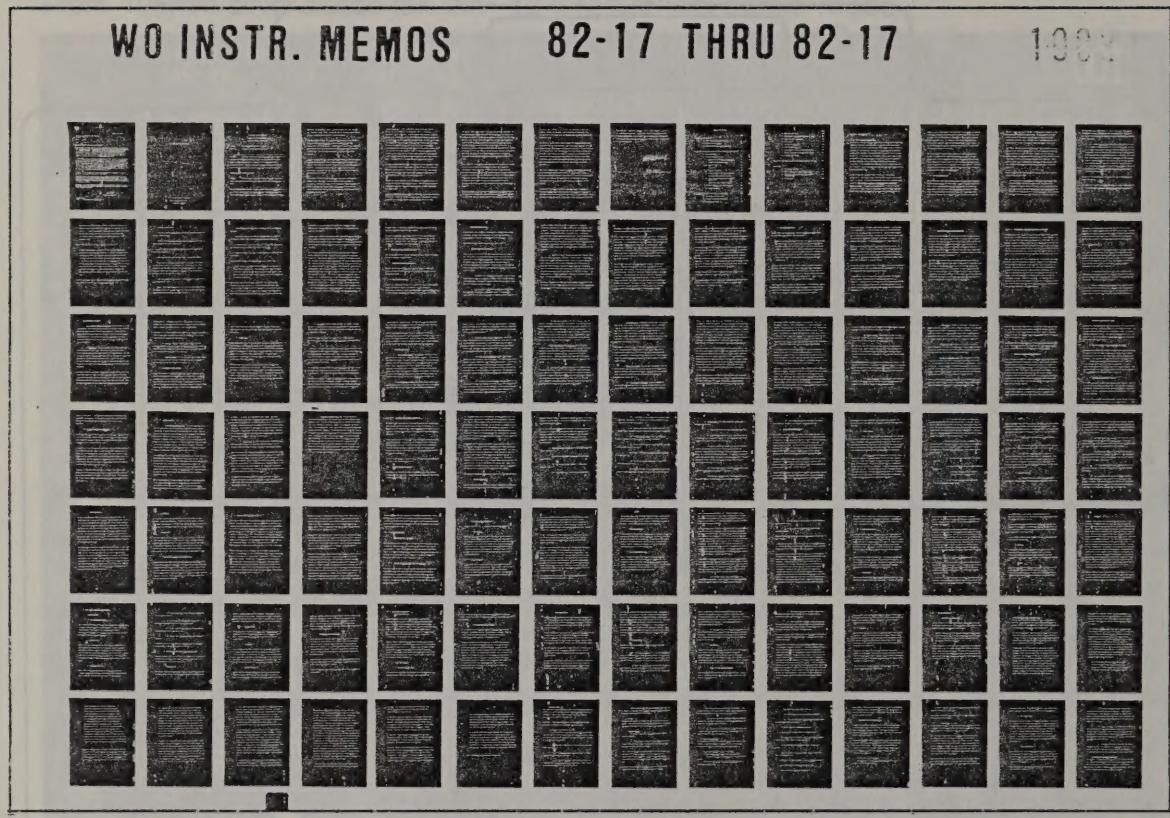
Cut sheet (tabbed) 105mm film--25X reduction: comic mode, positive polarity



MICROFICHE (105mm)

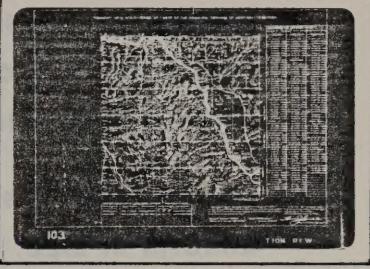
Step And Repeat Filming

From 105mm silver halide roll film---24X reduction: comic mode



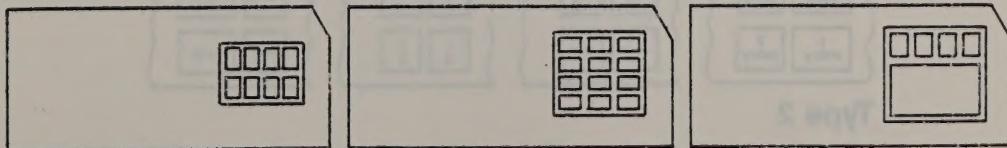
Note: The step and repeat filming process does not allow for
filming sequence errors.

APERTURE CARDS

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									103	

- Aperture cards are best suited to field record systems requiring constant updating.
- Additional record information can be typed onto the card.
- Self-contained camera/processors provide short turn-around for "in-field" records distribution. (Dark room facilities are not necessarily a requirement.)
- Aperture cards can also be mechanically assembled using roll film.
- Considerations for assembling an aperture card system are:
 1. Volume of records to be microfilmed.
 2. Necessity, if any, for retrieval equipment.
 3. Dimensions of the documents.
 4. The storage space for the documents and aperture cards is not a factor.

Other Aperture Card Forms



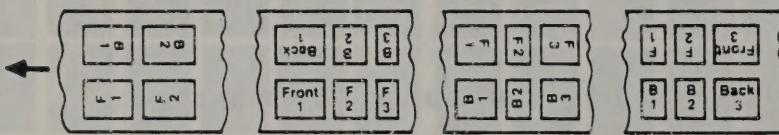
MICROFILM (16mm) Duplex Format Roll Film

- Duplex filming is most used where there is a need to film both sides of a document, side by side, simultaneously.
- Duplex filming is done on a high speed, self feeding, rotary camera with built in mirrors or prisms which provides for both-side image scanning without having to turn the document over.
- Duplex filming is most satisfactory when all documents being filmed are uniform in size.
- Systemized image retrieval can be accomplished from the roll film by alpha, numeric, image count (odometer), blip, bar, and photo-optical coding, or a combination of any of these that are properly indexed.

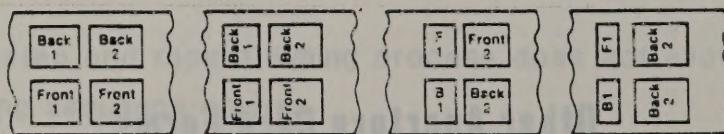
Duplex Filming (16mm)

Silver halide 16mm roll film--- System requirements dictate reduction ratios and filming mode.

Leading end of film



Type 1



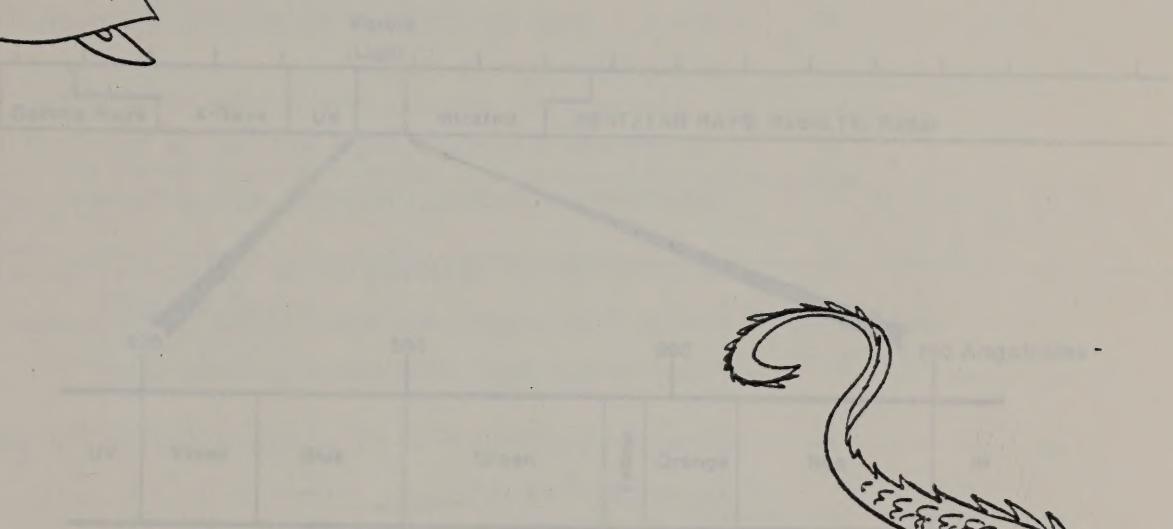
Type 2

1276 Microfilm



The Magic

ELECTROMAGNETIC SPECTRUM

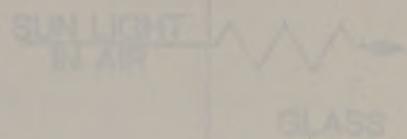


* The visible portion of the spectrum has been shaded.

of Photography



THE SPEED OF LIGHT

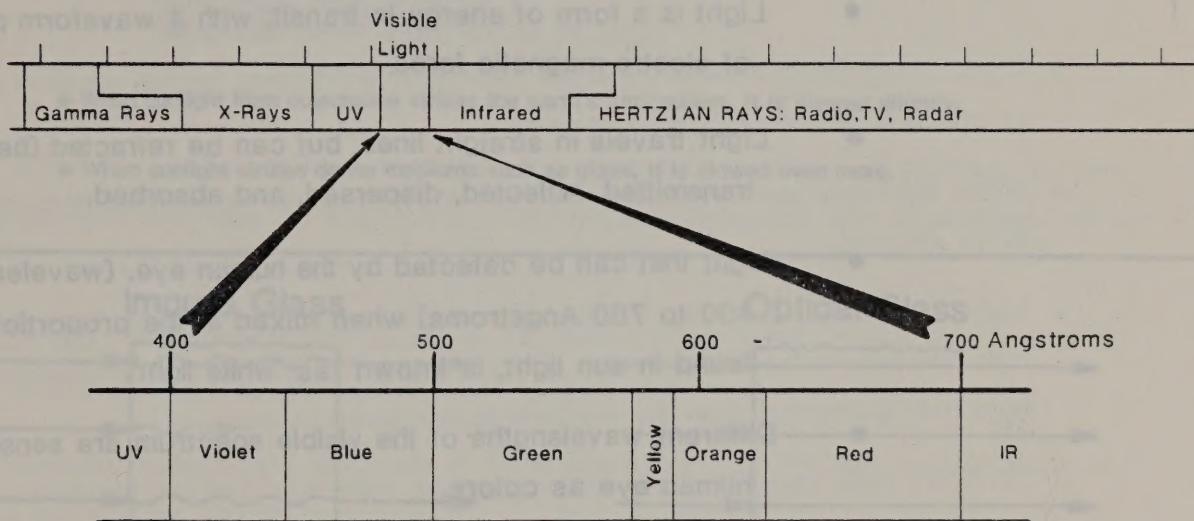


ATMOSPHERE
C 1931 30 231 TR 39088

GLASS

- The electromagnetic spectrum is composed of a wide range of energy waveforms. The length of each waveform (wavelength), as measured in Angstroms, determines whether it can be seen by the human eye as color or must be sensed by other means.

THE ELECTROMAGNETIC SPECTRUM



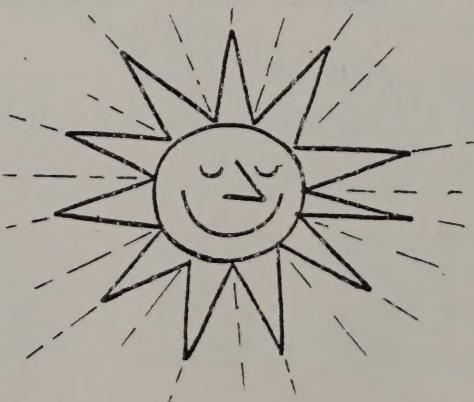
VISIBLE LIGHT

- The small portion of the spectrum that can be detected by the eye, is known as visible light.

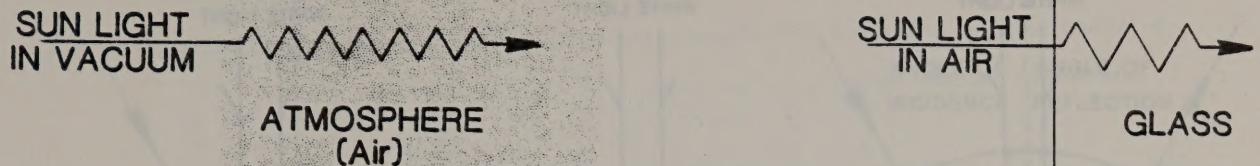
- Light glass slows and also bends some of the light as it passes through it. The light that emerges is called as color.
- Light absorption in colored filters. These are filters which absorb certain colors of light before they pass through them, resulting in clear or colored images.
- Optical glass allows most of the light to pass through, thus the camera lens can "see" much of what the human eye can't see.

PROPERTIES OF LIGHT

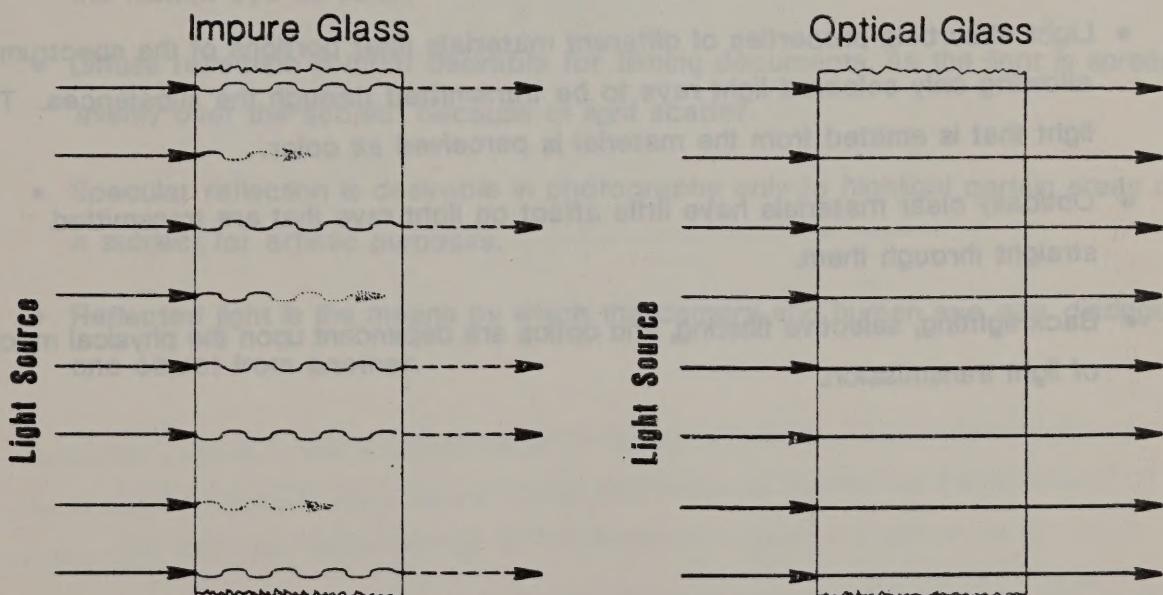
- Light travels at 186,000 miles per second.
- Light is invisible until it strikes something.
- Light is a form of energy in transit, with a waveform pattern of electro-magnetic force.
- Light travels in straight lines, but can be refracted (bent), transmitted, reflected, dispersed, and absorbed.
- Light that can be detected by the human eye, (wavelengths from 400 to 700 Angstroms) when mixed in the proportions as found in sun light, is known as "white light".
- Different wavelengths of the visible spectrum are sensed by the human eye as colors.
- Black and white films are formulated to imitate the human eye, only in this case, colors are captured as shades of gray. This ability is known as "color sensitivity".



THE SPEED OF LIGHT

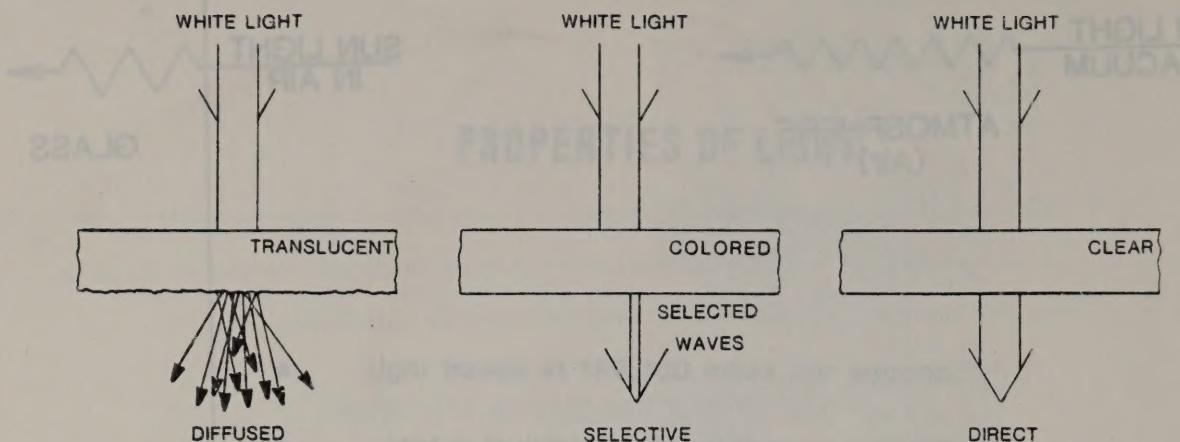


- When sunlight from outer space strikes the earth's atmosphere, it is slowed slightly.
- When sunlight strikes dense mediums such as glass, it is slowed even more.

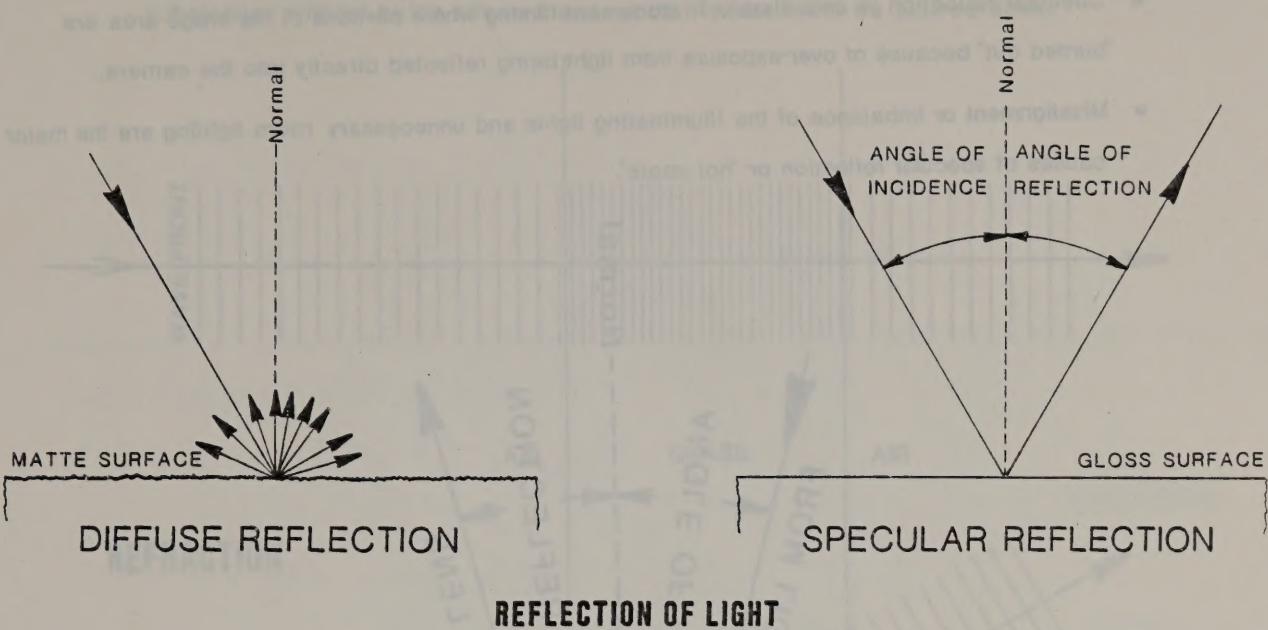


- Impure glass slows and also absorbs some of the light passing through it. The light that emerges is sensed as color.
- Light absorption in photographic filters is used to an advantage when certain bands of light waves can be eliminated from the visible spectrum, resulting in clearer and sharper photo images.
- Optical glass allows most of the light to pass through, thus the camera lens can "see" much of what the human eye can view.

TRANSMISSION OF LIGHT



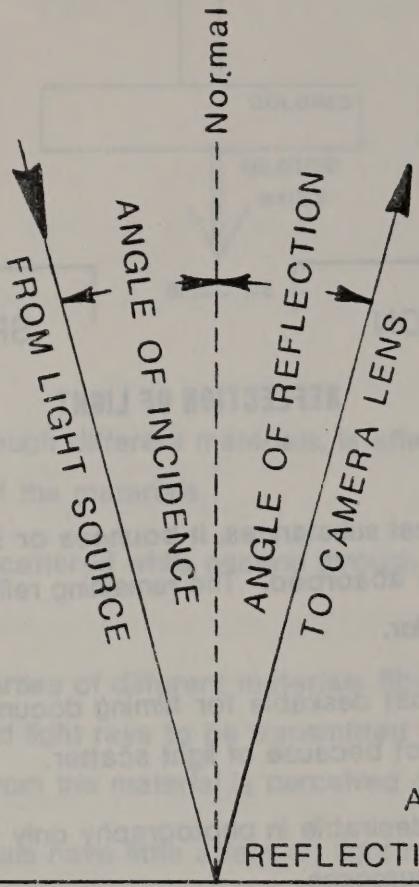
- Light, transmitted through different materials, is affected by the physical and chemical properties of the materials.
- When light rays are scattered while passing through a material, the light is said to be diffused.
- Light absorbing properties of different materials filter portions of the spectrum allowing only selected light rays to be transmitted through the substances. The light that is emitted from the material is perceived as color.
- Optically clear materials have little affect on light rays that are transmitted straight through them.
- Back-lighting, selective filtering, and optics are dependant upon the physical mechanics of light transmission.



REFLECTION OF LIGHT

- When light strikes most substances, it bounces or is reflected. Portions of the spectrum can also be absorbed. The remaining reflected light is distinguished by the human eye as color.
- Diffuse reflection is most desirable for filming documents, as the light is spread evenly over the subject because of light scatter.
- Specular reflection is desirable in photography only to highlight certain areas of a subject for artistic purposes.
- Reflected light is the means by which the camera and human eye can distinguish one object from another.

- Specular reflection is undesirable in document filming where portions of the image area are "burned out" because of over-exposure from light being reflected directly into the camera.
- Misalignment or imbalance of the illuminating lights and unnecessary room lighting are the major causes of specular reflection or "hot spots".



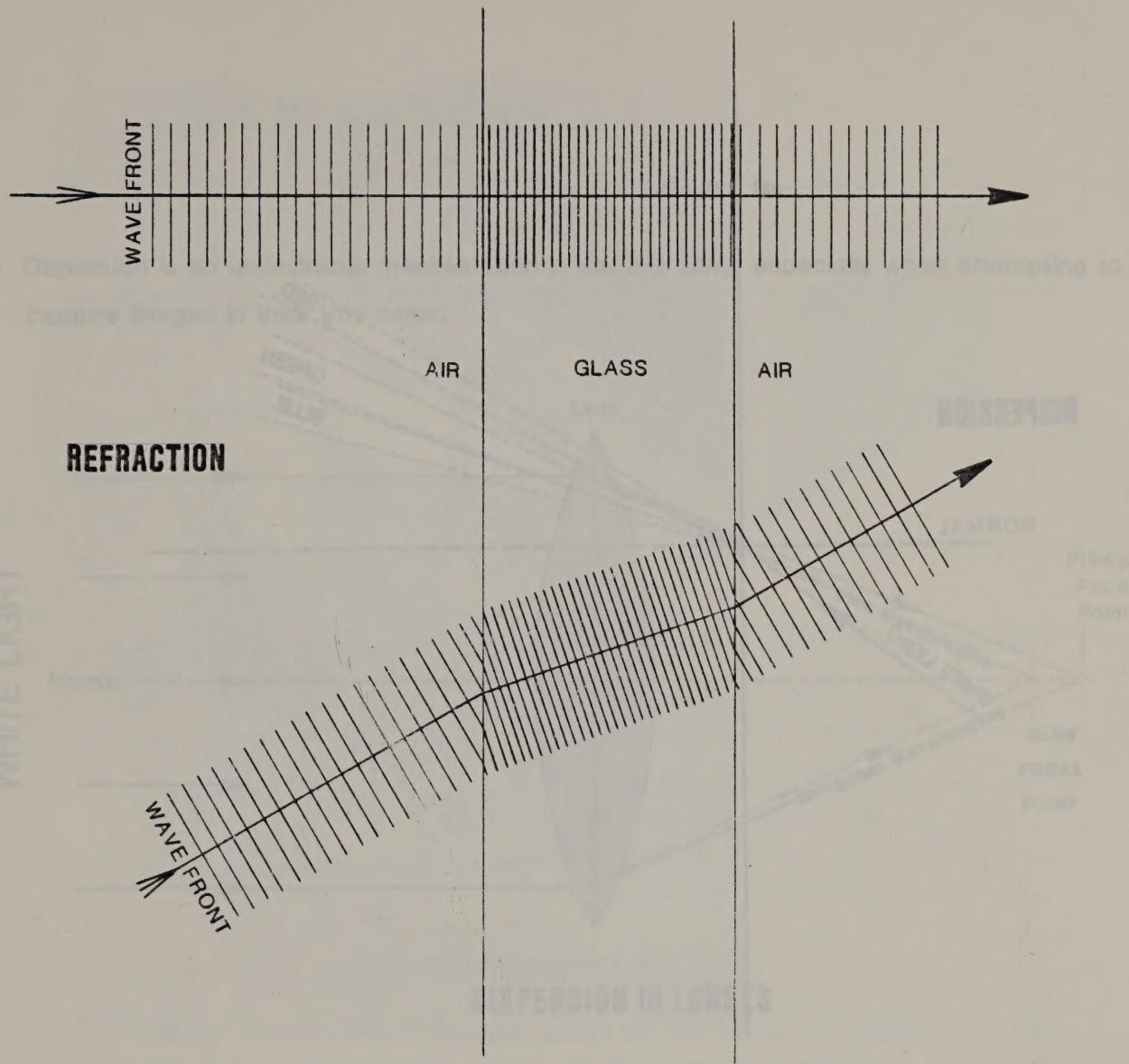
HOT SPOTS

- The angle formed between a line projected in a direct line from a light source to a reflective surface, and a line (normal) drawn perpendicular to the point where the light strikes, is equal to the angle formed between the normal and the light reflected away from the surface, or in other words:

The Angle Of Incidence = The Angle Of Reflection

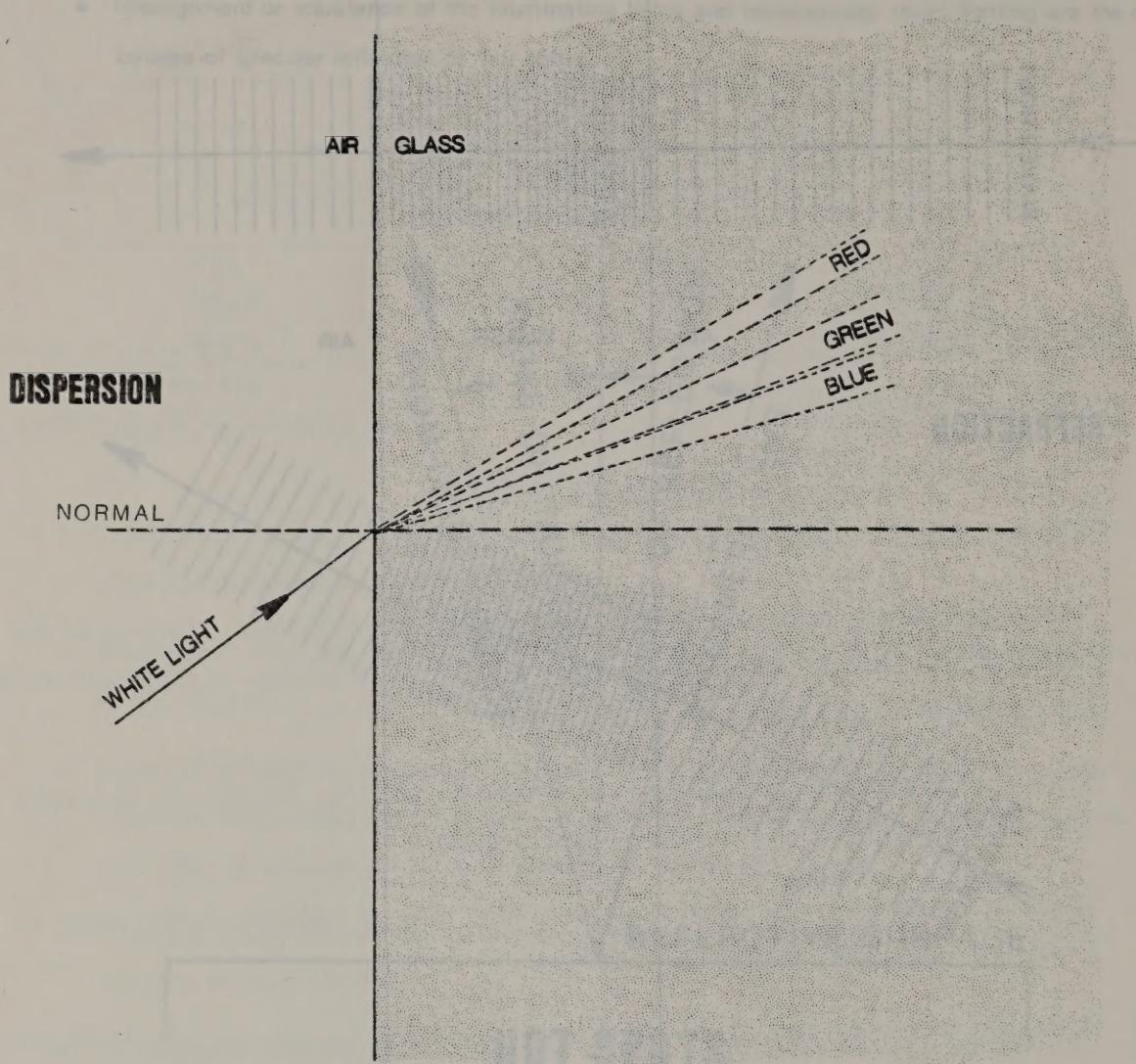
Therefore, all illuminating lights must be adjusted so they will not reflect directly into the camera lens and cause hot spots.

- Light, being a wave form type of energy, will pass directly through many transparent substances without being affected except that it that it will be slowed down.



- When light penetrates a transparent substance at an angle, the apex of the wave is slowed before the center or node, which causes the light ray to bend. As the light ray leaves the substance, it is bent again as it speeds up.
- The ability of transparent materials to bend or refract light enables us to construct lenses.

- Light entering a transparent material at an angle not only is bent, or refracted, but because of the differences in frequencies of each separate wavelength, it can also be broken up to display each of its component colors or bands. This phenomenon is called dispersion.
- Light in the blue band will be bent more than light in the red band.

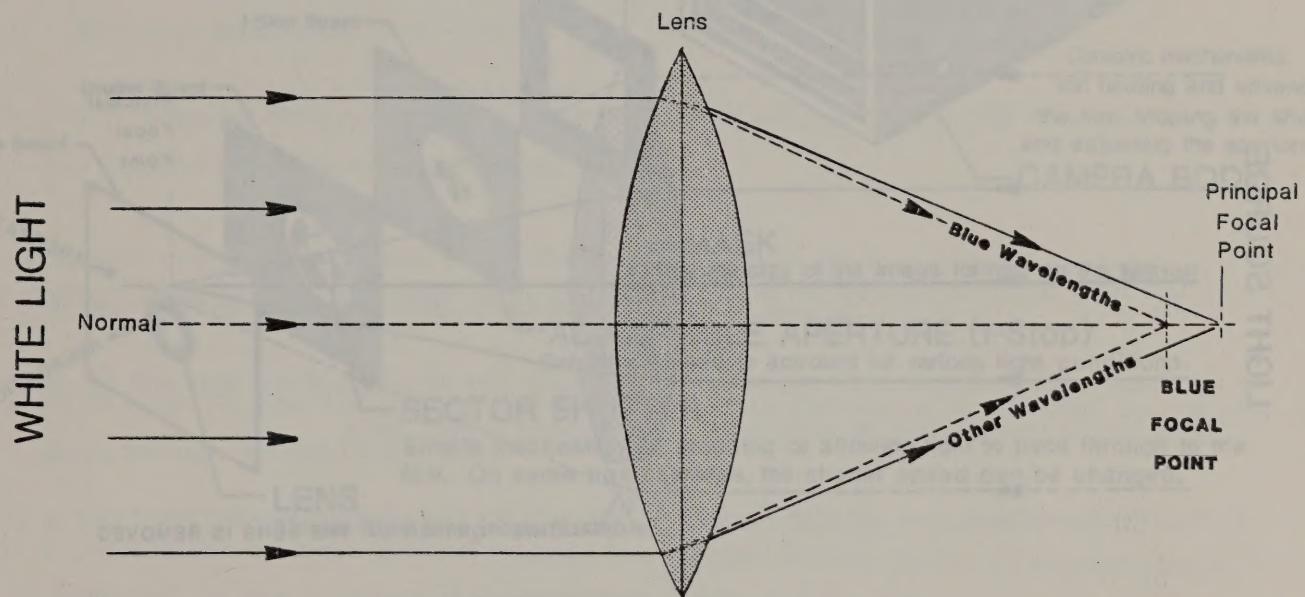


- Light entering a transparent material at an angle not only is bent, or refracted, but because of the differences in frequencies of each separate wavelength, it can also be broken up to display each of its component colors or bands. This phenomenon is called dispersion.
- Light in the blue band will be bent more than light in the red band.

Therefore, all dispersive lenses must be oriented so they will refract light to form real and weak hot spots.

THE BOX CAMERA

- Dispersion is an undesirable manifestation in photography, especially when attempting to capture images in their true color.



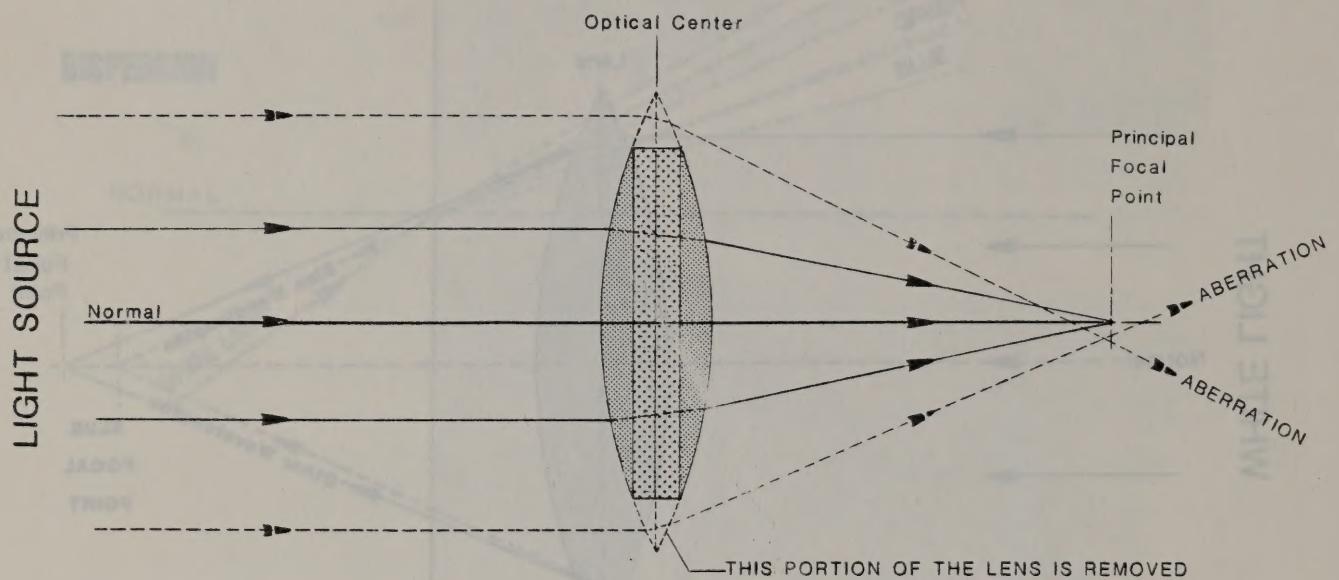
DISPERSION IN LENSES

- Dispersion is most prominent in simple lenses where blue wavelengths converge at a different focal point than the one designed for the lens.
- Dispersion is the reason blue and purple inks are difficult to photograph.

LENSES

The following briefly reviews the uses of the compound lens to reduce the low resolution caused by diffused illumination.

- Inexpensive camera lenses distort the images projected through them. This imperfection is called spherical aberration.
- Spherical aberration accounts for pictures being in focus in the center and blurred along the edges.

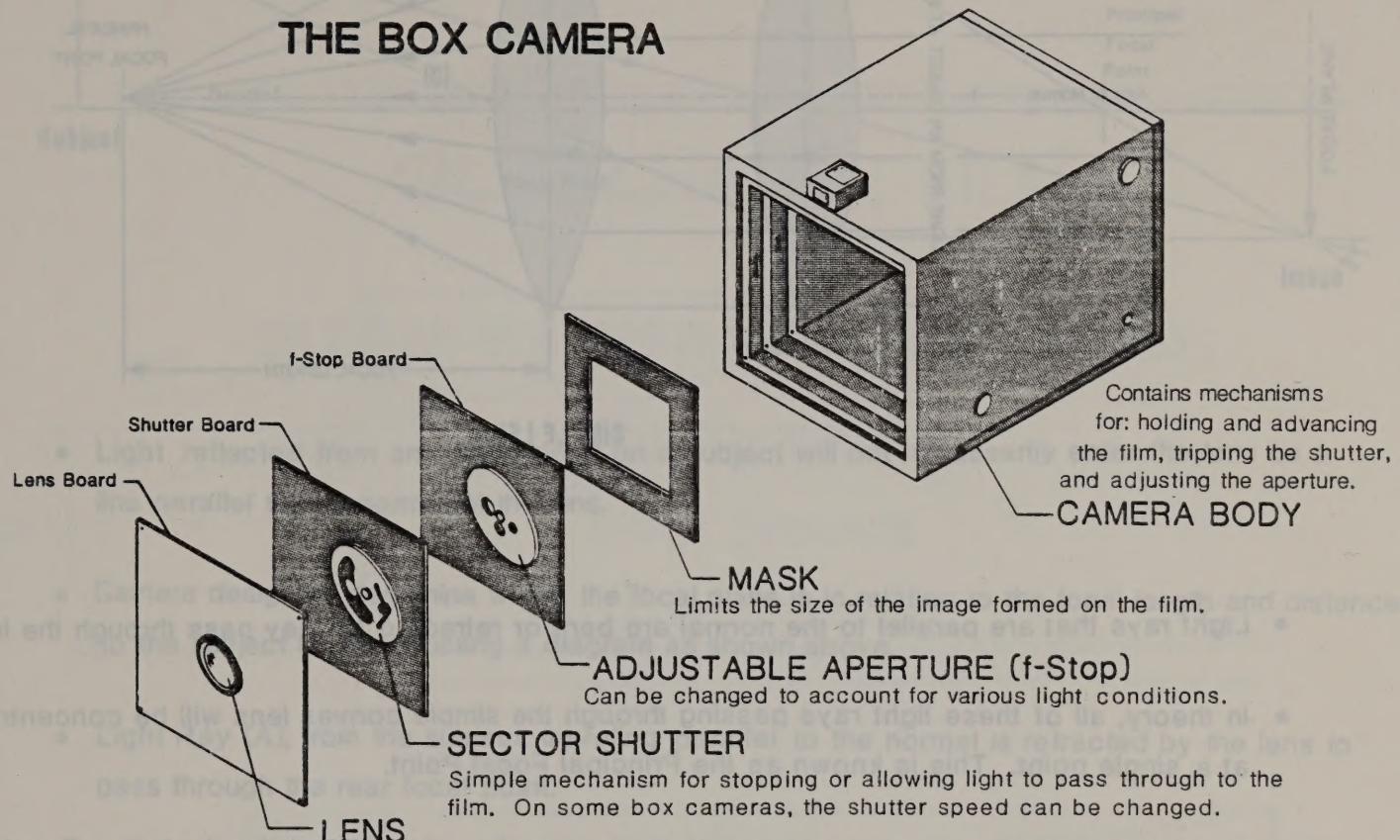


ABERRATIONS

- It is almost impossible to grind a lens with perfect curvature on both surfaces. Therefore, all light passing through the lens will not converge at a single focal point.
- Some of this type of aberration can be corrected by removing the outer edge of the lens.

The box camera and microfilm camera are similar in concept, as their use is limited to unpretentious photography.

THE BOX CAMERA



THE MICROFILM CAMERA

• APERTURE

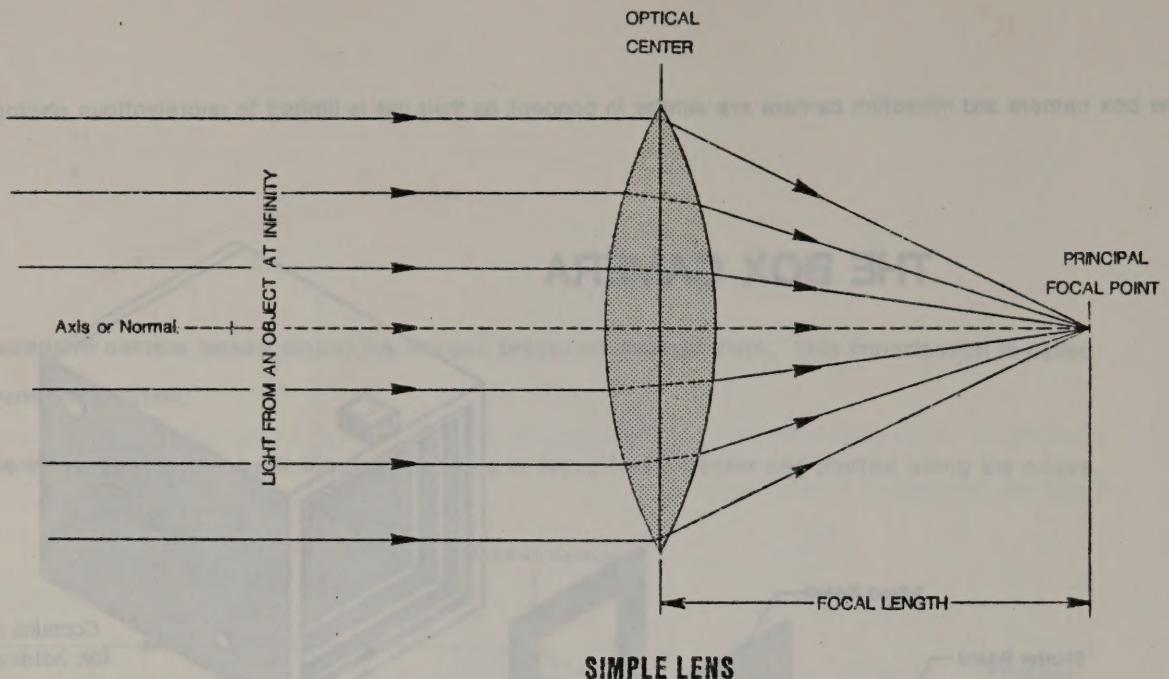
The aperture is fixed on the microfilm camera. Lighting variations are attained by adjusting the voltage on the illuminating lights.

• SHUTTER

The microfilm camera shutter operates at a fixed speed.

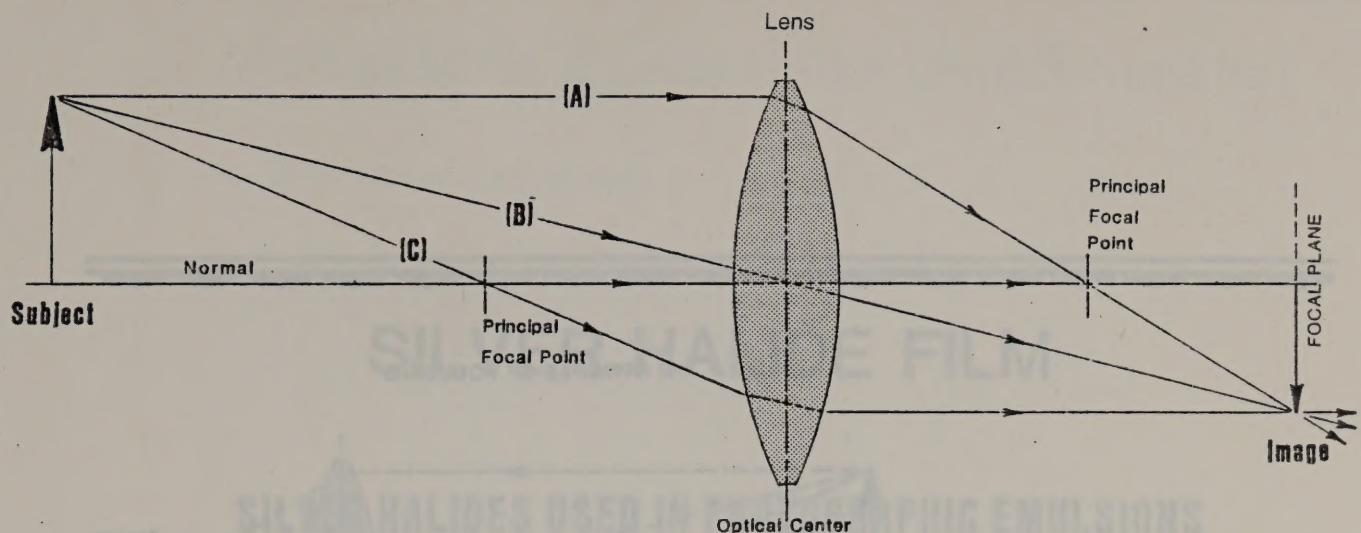
• LENS

The microfilm camera requires the use of the compound lens to obtain the fine resolution needed to capture microimages.



- Light rays that are parallel to the normal are bent or refracted as they pass through the lens.
- In theory, all of these light rays passing through the simple convex lens will be concentrated at a single point. This is known as the Principal Focal Point.
- The distance from the optical center of the lens to the principal focal point is the Focal Length of the lens.
- The focal length of a lens will not change once the curvature of the lens surfaces have been ground.
- Focal length is a leading factor in the design of lenses and cameras.
- In a camera, light from a subject must be gathered, concentrated, and focused on a focal plane, or film, which can capture the image. This is done through the use of a proper lens.

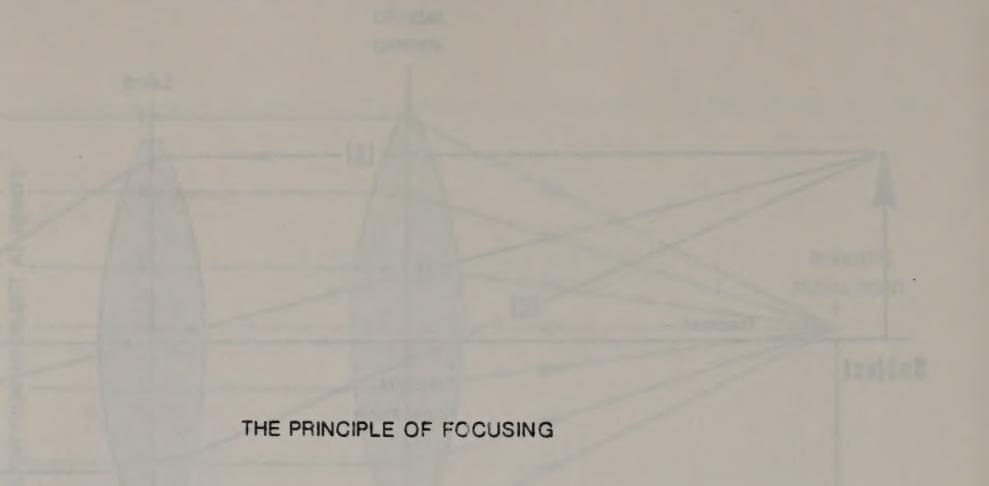
THE IMAGE



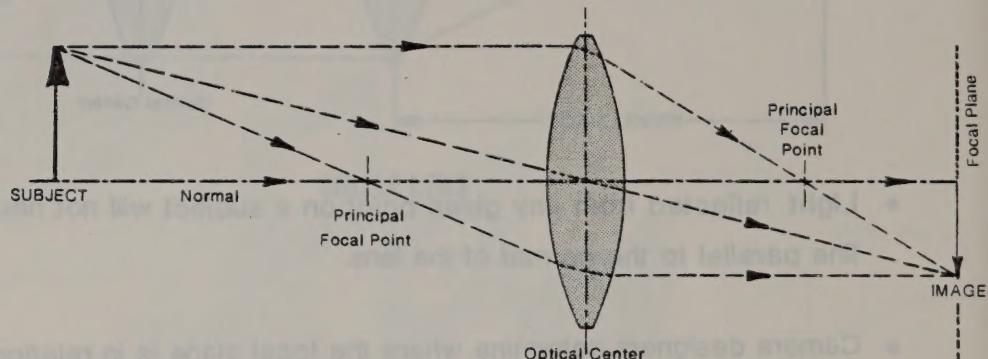
- Light reflected from any given point on a subject will not necessarily enter the lens on a line parallel to the normal of the lens.
- Camera designers determine where the focal plane is in relation to the focal length and distance to the subject by constructing a diagram as shown above.
- Light Ray (A), from the subject, traveling parallel to the normal is refracted by the lens to pass through the rear focal point.
- Light Ray (B), from the subject, passes through the optical center of the lens, but is not refracted, as the surfaces of the lens are parallel to each other.
- Light Ray (C), passes through the front focal point and is refracted by the lens to run parallel with the normal.
- The point at which these light rays converge is the area of sharpest focus of the image and is determined to be the focal plane.
- The size of the subject, and the distance from the optical center requires that the lens must be moved forward or backward to bring about sharp focus, because in most cameras, the lens focal length and the focal plane are fixed.

CHAPTER EIGHT

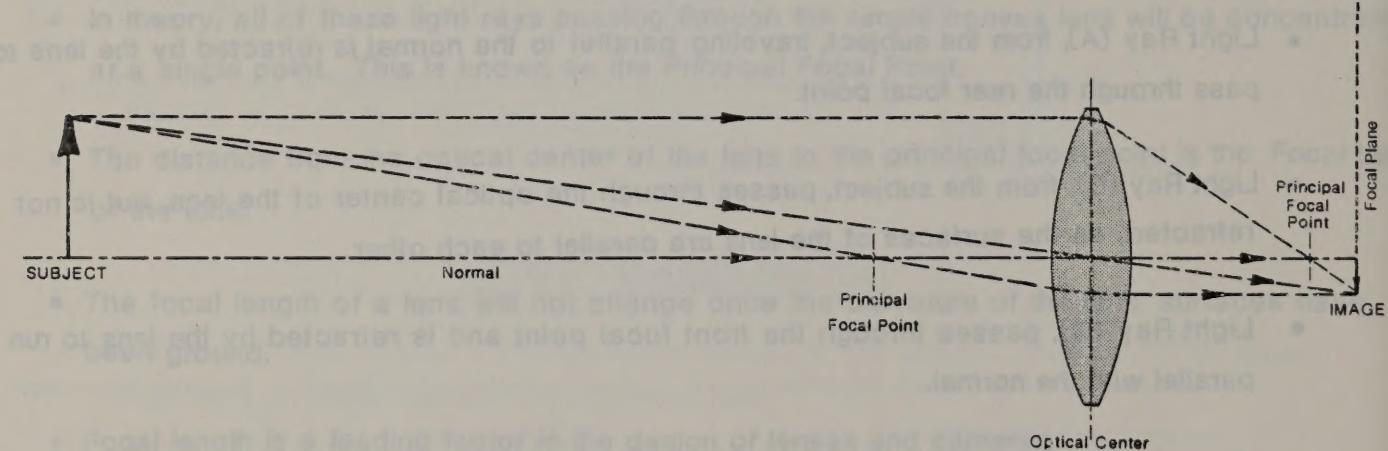
OPTICAL
CENTERS



THE PRINCIPLE OF FOCUSING



The principal focal points of the lens, and the focal plane are fixed. As the distance from the subject to the optical center changes, the distance from the optical center to the focal plane must also be changed, by moving the lens, to maintain sharp focus.



- The distance from the optical center of the lens to the principal focal point is the Focal Length of the lens.
- The focal length of a lens will not change once it is made or mounted on a camera body.
- Focal length is a leading factor in the design of lenses and cameras.
- In a camera, light from a subject must be focused on a single plane, or film, which can capture the image. This is done through the use of a proper lens and lens mount.

BLACK-AND-WHITE SILVER HALIDE FILMS

Micrographic Camera Film (Panchromatic)

* Blue-Green-Red Sensitive

SILVER HALIDE FILM

SILVER HALIDES USED IN PHOTOGRAPHIC EMULSIONS

Silver Iodide

Silver Bromide

Silver Chloride

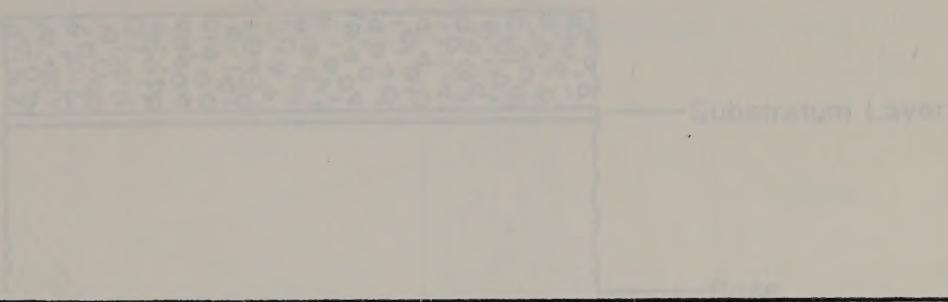
COM Films

* Blue-Extended Blue Sensitive

BLACK-AND-WHITE SILVER HALIDE FILMS

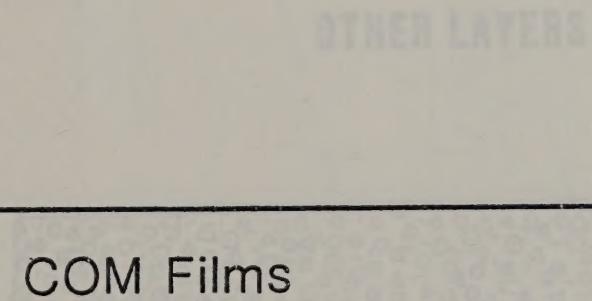
Micrographic Camera Film (Panchromatic)

- Blue-Green-Red Sensitive



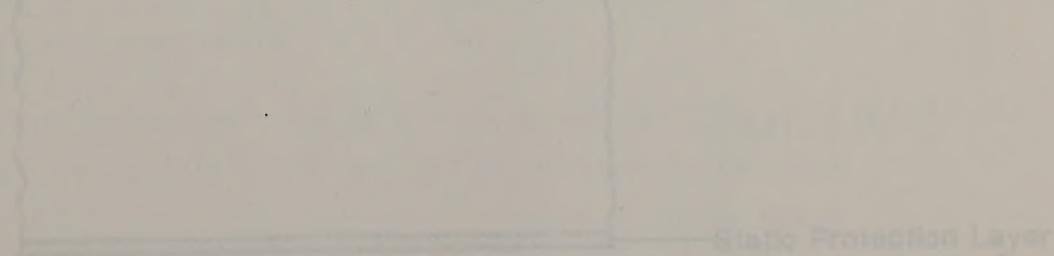
Micrographic Duplicating Film (Orthochromatic or Extended Blue)

- Blue-Green Sensitive

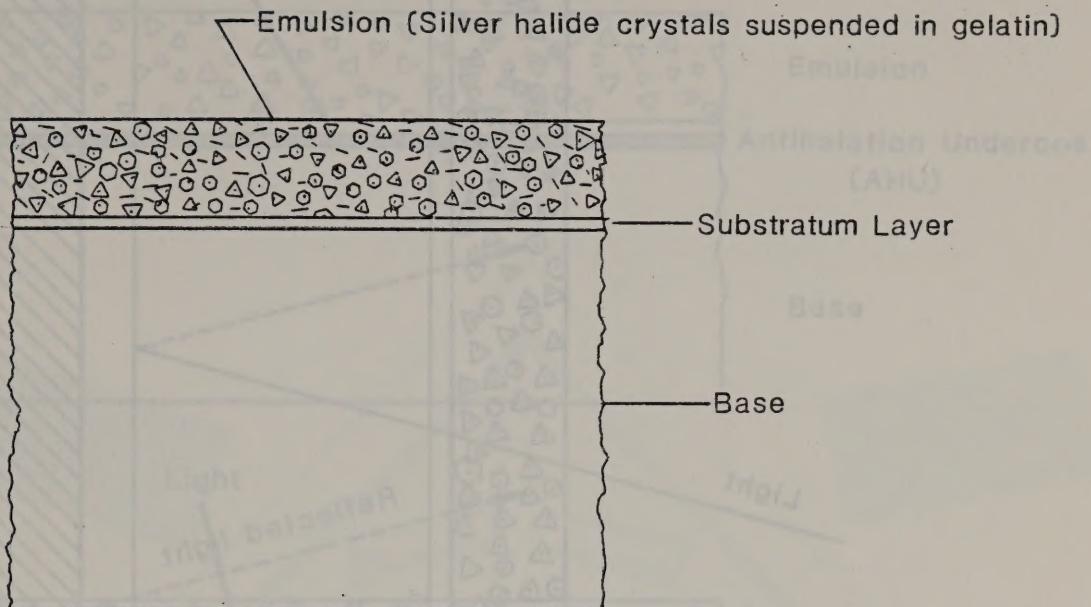


COM Films

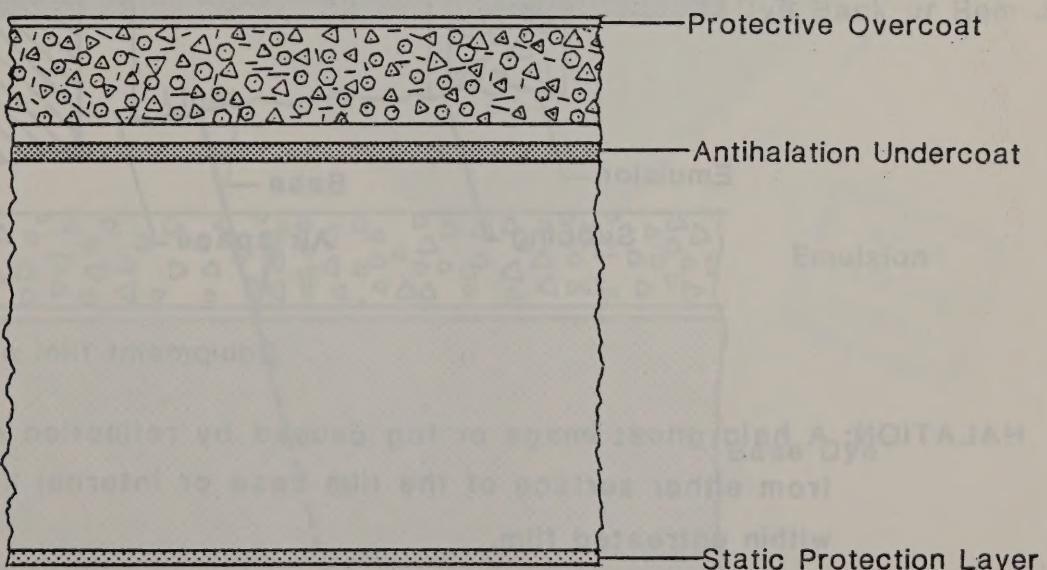
- Blue-Extended Blue Sensitive



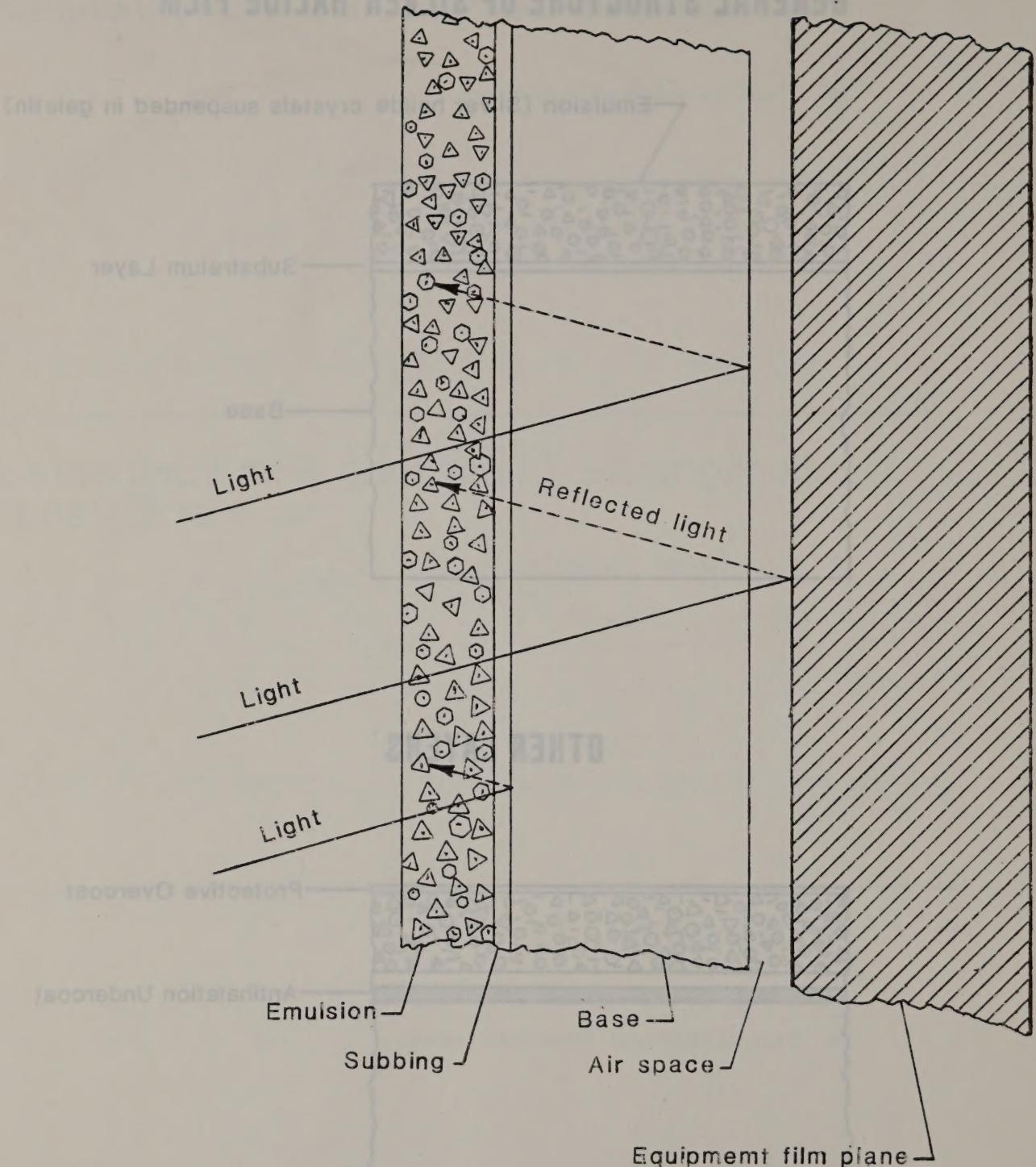
GENERAL STRUCTURE OF SILVER HALIDE FILM



OTHER LAYERS



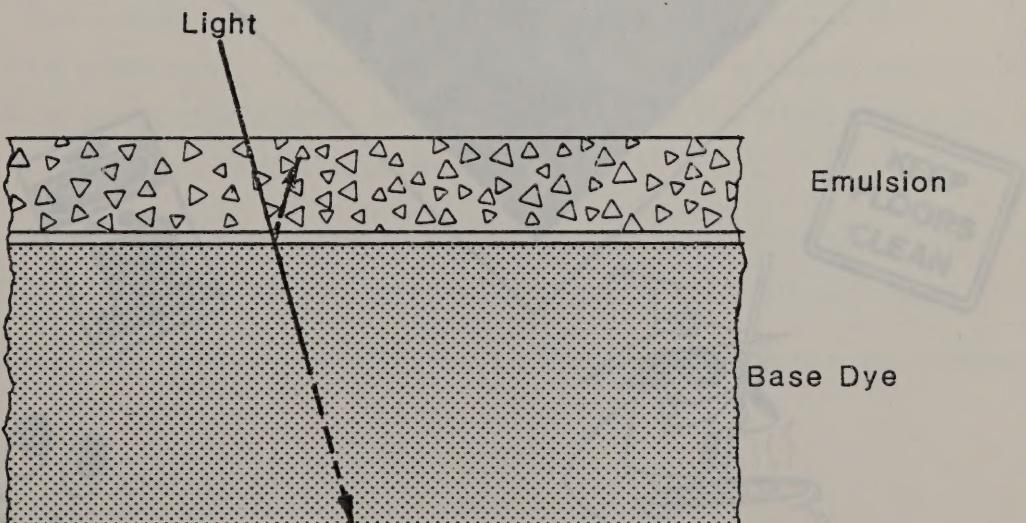
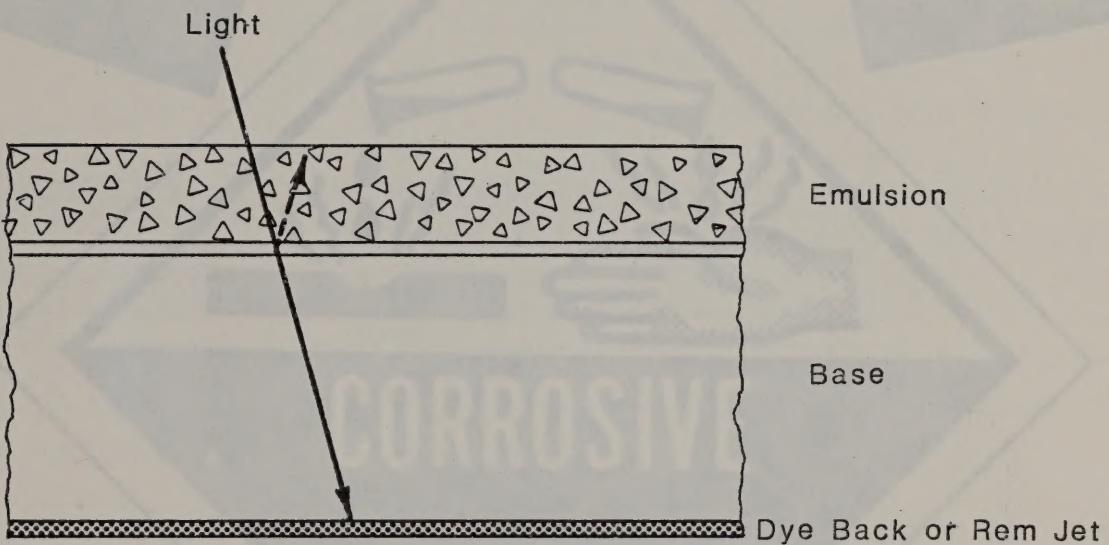
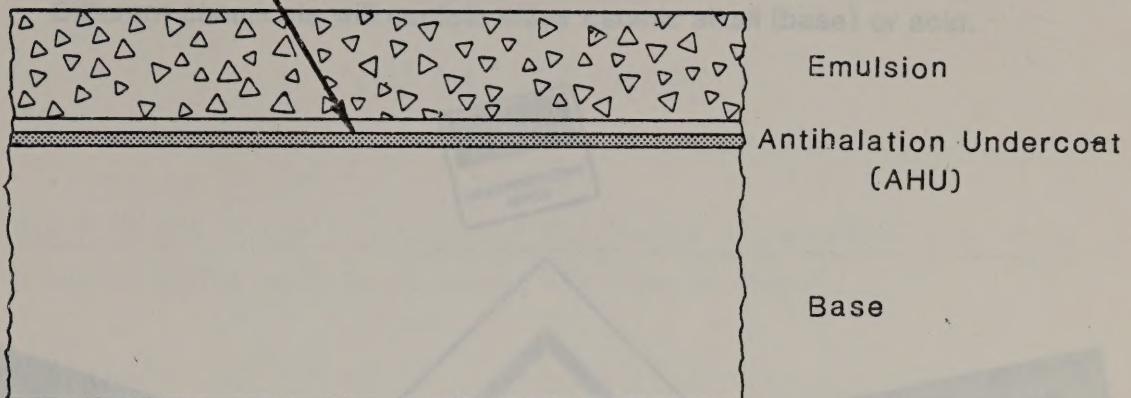
HALATION FROM REFLECTED LIGHT



HALATION: A halo ghost image or fog caused by reflection of rays of light from either surface of the film base or internal light scattering within untreated film.

ANTIHALATION TREATMENTS

CAUTION: Handle all photo processing chemicals with care.
Wear eye protection and protective clothing whenever changing chemistry.



CAUTION: Handle all photo processing chemicals with care.

Wear eye protection and protective clothing whenever changing chemistry.

Different chemicals will contain either caustic alkali (base) or acid.



READ AND HEED!!!!!!

THE LATENT IMAGE

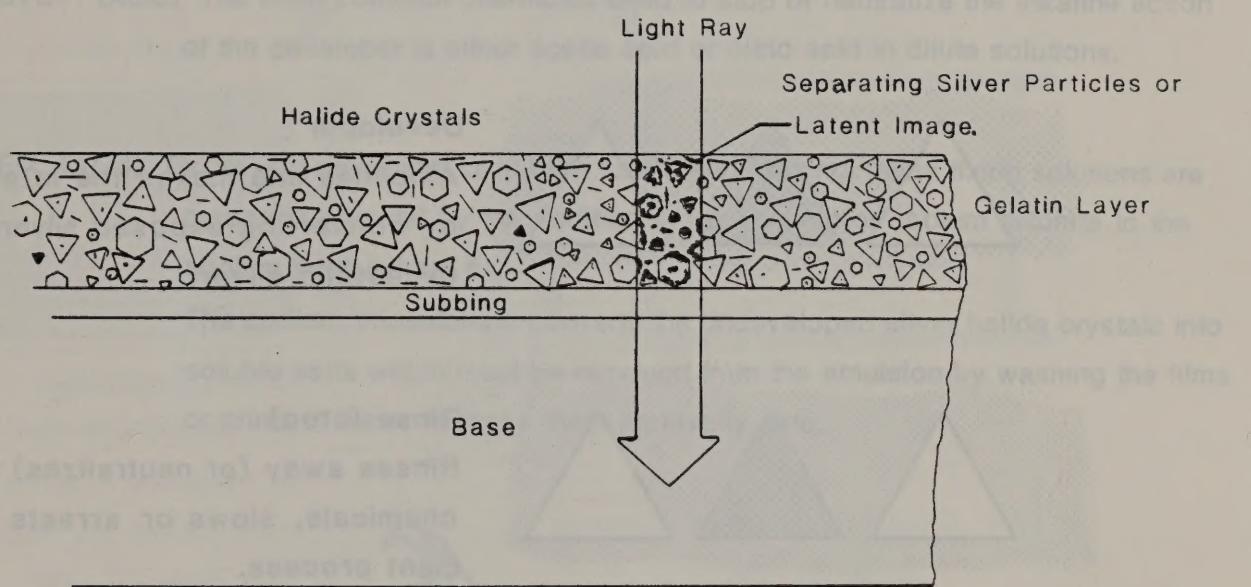
THE LATENT IMAGE

THE LATENT IMAGE

THE LATENT IMAGE

- The invisible image produced by the action of radiant energy on a photosensitive surface is called the "Latent Image".

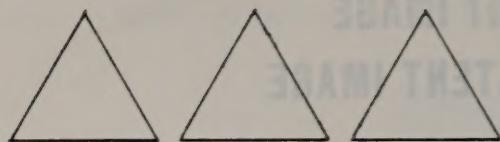
EXPOSURE



- The controlled exposure of a photosensitive surface through a shuttered lens or by contacting with a masking film will affect only the area that receives the radiant energy.
- Although the photochemistry of the various microfilms (silver halide, diazo, TEP, etc) is different, upon exposure, all of them will have a latent image.
- Latent images are intensified or made visible in the development process.

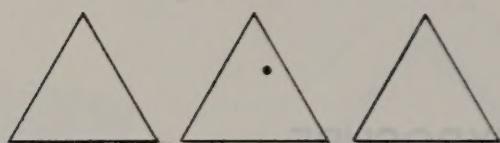
THE DEVELOPMENT PROCESS

STEPS



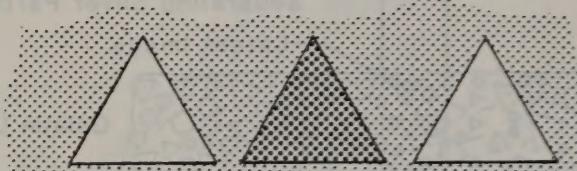
Unexposed Silver Halide

No chemical activity will take place until the film is exposed to light or excess heat, (70 degrees and above).



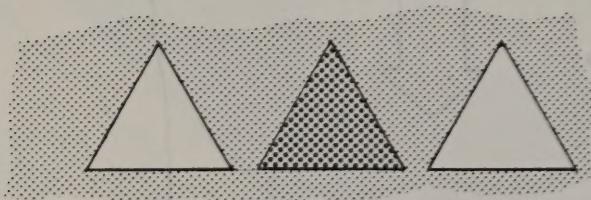
Latent Image

Exposure to light begins the photochemical process.



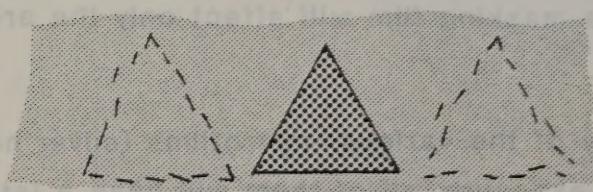
Developer

Amplifies and makes the latent image visible by converting exposed silver halide crystals to metallic silver.



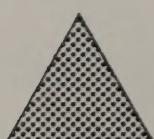
Rinse (stop)

Rinses away (or neutralizes) the developer chemicals, slows or arrests the development process.



Fixer

Removes unexposed silver halide crystals from the emulsion.



Wash

Removes fixer and byproducts from the emulsion.

THE CHEMISTRY OF SILVER HALIDE FILM PROCESSING

- DEVELOPER: (Base) The most generally used developing agents are metol, hydroquinone, or Phenidone.

Developing speed is accelerated by the addition of an alkali solution of borax, sodium carbonate, or sodium hydroxide.

Preservatives used in developers can be sodium sulphite or potassium metabisulphite.

An anti-foggant used is potassium bromide.

- STOP: (Acid) The most common chemicals used to stop or neutralize the alkaline action of the developer is either acetic acid or citric acid in dilute solutions.

- FIX: (Acid) To prevent developer oxidation stains and fogging, many fixing solutions are made more acidic by the addition of acetic acid or sodium sulphite to the sodium thiosulphate fix.

The sodium thiosulphate converts the undeveloped silver halide crystals into soluble salts which must be removed from the emulsion by washing the films or prints in water to make them archivally safe.



GENERATION AND POLARITY

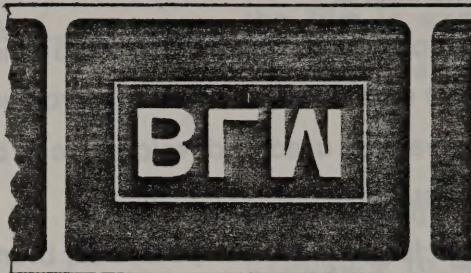
BLM

Original Document

When duplicating from one film to another, there is always a loss of resolution. There can be as much as a 10% loss of resolution in each succeeding generation if the original image (first generation) is not filmed with as much precision as possible.

NOTE: The emulsion is on the dull side of the film.

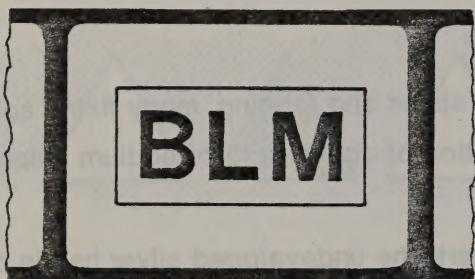
Original Image



Camera Film

- First Generation.
- Negative Polarity
- Emulsion On Reverse Reading Side

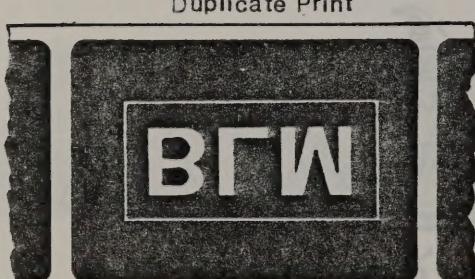
Duplicate Print



Conventional Film

- Second Generation Image
- Positive Polarity
- Emulsion On Right Reading Side Of Film

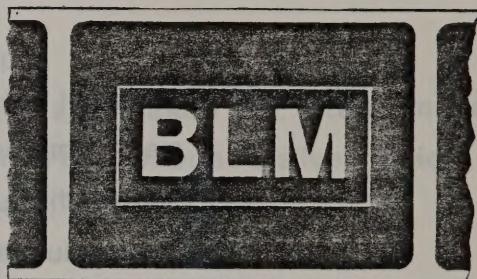
Duplicate Print



Conventional Film

- Third Generation Image
- Negative Polarity
- Emulsion On Reverse Reading Side Of Film

Duplicate Print



Direct Duplicating Film

- Second Generation Image
- Negative Polarity
- Emulsion On Right Reading Side Of Film

Duplicate Print



Direct Duplicating Film

- Third Generation Image
- Negative Polarity
- Emulsion On Reverse Reading Side Of Film

FORMATTING ORIGINAL FILM AND DUPLICATE FILM

Roll film is always duplicated.
emulsion to emulsion.

Negative Polarity

Emulsion on reverse reading side of film.

ROLL #1

Original Film

(For duplicating security copies
or jacketing)

Can Be Either
Negative Or Positive Polarity

Emulsion on right reading side of film.

0

ROLL #2

Second Generation Duplicate
(Security copy)

TO USE:

- Photograph the test chart at 100% resolution.
- View the processed negative or positive duplicate.
- Find the smallest printed character that can be read between 1.00 and 1.20 on the densitometer.
- Measure the width of the character in millimeters.
- Divide the width of the character by the number of times the original was enlarged to obtain the resolution.
- Resolution must equal a minimum of 110 lines per millimeter or more.

Negative Polarity

Emulsion on reverse reading side of film.

0

ROLL #3

Third Generation Duplicate
(For jacketing)

Since reflectance varies from one document to another, you must change the intensity of the illuminating lights to obtain more consistent densities from one finished photographic frame to the next. This is a requirement of a good microfilm system. Therefore you must understand:

RECIPROCITY

• RECIPROCITY LAW

$$\text{Density} = \text{Illumination} \times \text{Time}$$

i.e.

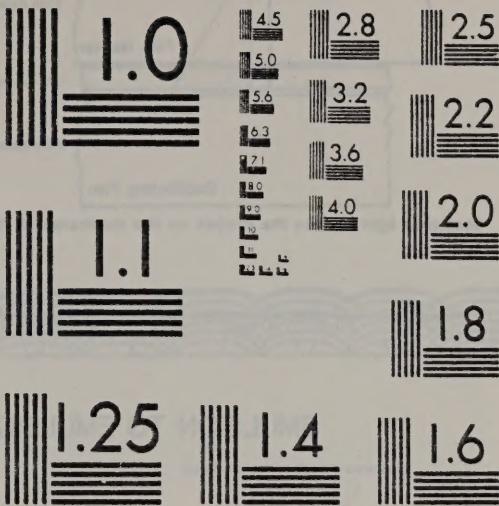
$$\text{Bright light} \times \text{Short time} = \text{Dim light} \times \text{Long time}$$

- However, for very short or very long exposures, this is not always true.
- Film speed can sometimes vary over wide ranges even though total or equivalent light is the same.
- This is known as....

RECIPROCITY FAILURE.

SHARP FOCUS OR RESOLVING POWER

(line pairs per mm)



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

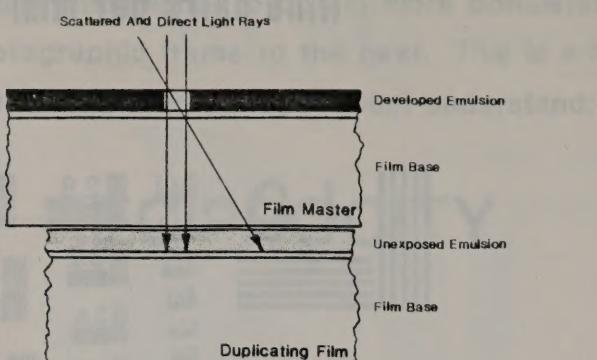
- Use only the test charts prepared by the National Bureau of Standards.
- Resolving power is dependant upon sharp focus of the lens and the number of times an object is reduced, when the background density reads between 1.00 and 1.20 on the densitometer.
- The manufacturers published resolution indicates the limit of the film with a certain test object.
- Final or actual resolution is a measure of the total system.

TO USE:

- Photograph the test chart and process the film.
- View the processed photo under the microscope.
- Find the smallest pattern resolved on which the spaces between the lines still show line direction (at least one line/space in both vertical and horizontal patterns).
- Multiply the number of the test pattern resolved, by the number of times the image was reduced, to obtain the resolution.
- Resolution must equal a minimum of 110 lines per milimeter or more.

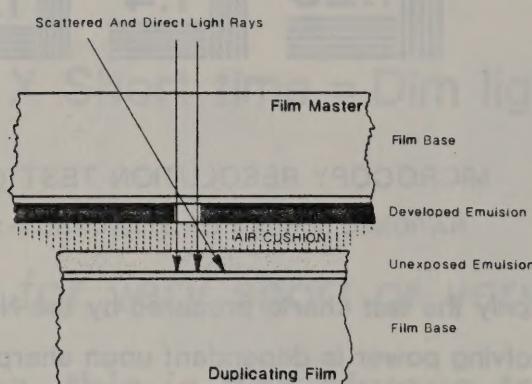
CONTACT DUPLICATING AND EFFECTS OF LIGHT SCATTER

BASE TO EMULSION



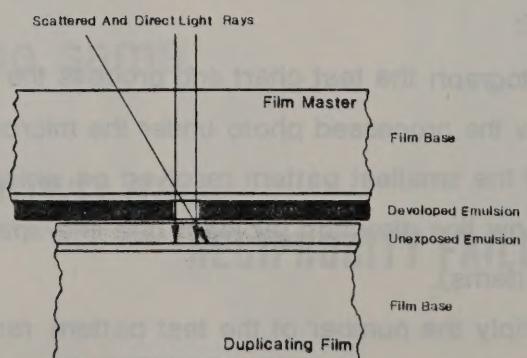
Scattered light causes the images on film duplicates to look fuzzy or out of focus.

EMULSION TO EMULSION



Even though the film is being duplicated emulsion to emulsion, sometimes a cushion of air can become trapped between the films, which is also a cause of light scatter.

EMULSION TO EMULSION



Emulsion to emulsion copying yields the smallest loss of resolution (sharpness) in the duplicating process.

GENERAL STRUCTURE OF DIAZO FILM
(Duplicating Film)



base or
er containing
um salts

Cyanoacrylate
Stabilizer

SUDAN I

OTHER MICROFILMS



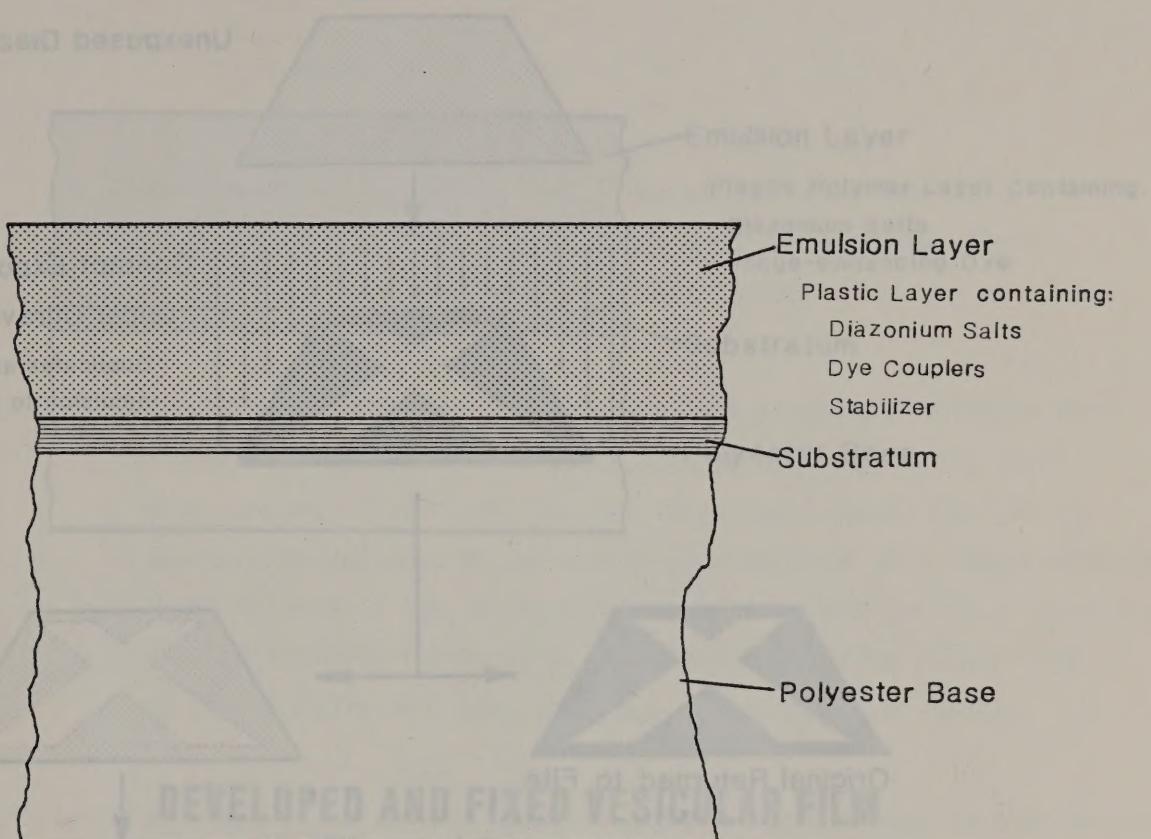
NOTE: Diazo film is a direct duplicating film, also referred to as auto-sensitizing film.

Observe safety precautions if you must handle aqueous ammonia (ammonia/water solution) or anhydrous ammonia (liquefied ammonia under pressure).

GENERAL STRUCTURE OF VESICULAR FILM

mild Isolating Agent

Water-soluble Polarity

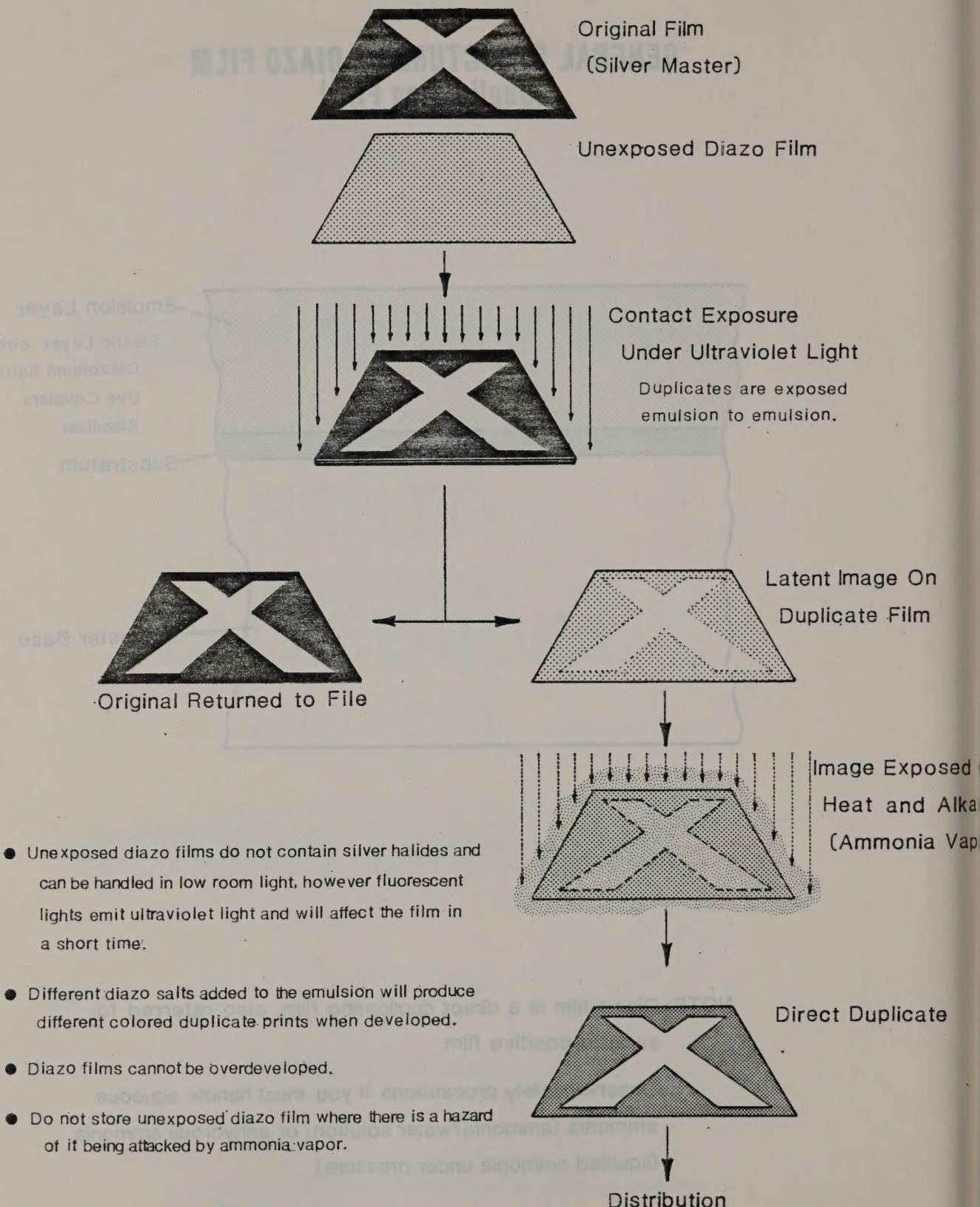
**GENERAL STRUCTURE OF DIAZO FILM
(Duplicating Film)**

NOTE: Diazo film is a direct duplicating film, also referred to as auto-positive film.

Observe safety precautions if you must handle aqueous ammonia (ammonia/water solution) or anhydrous ammonia (liquefied ammonia under pressure).

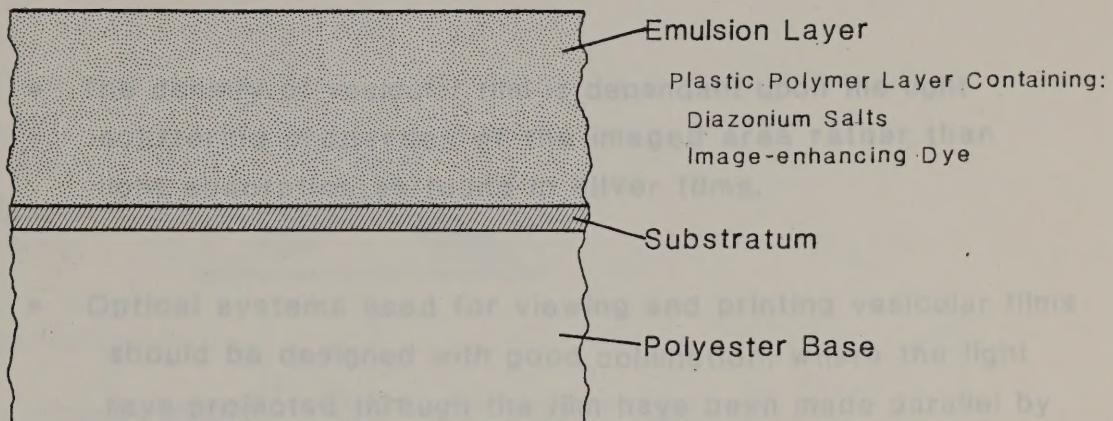
NOTE: Vesicular film is a sign-reversing process, or in other words, it produces negative-inverting images.

THE DIAZO PROCESS

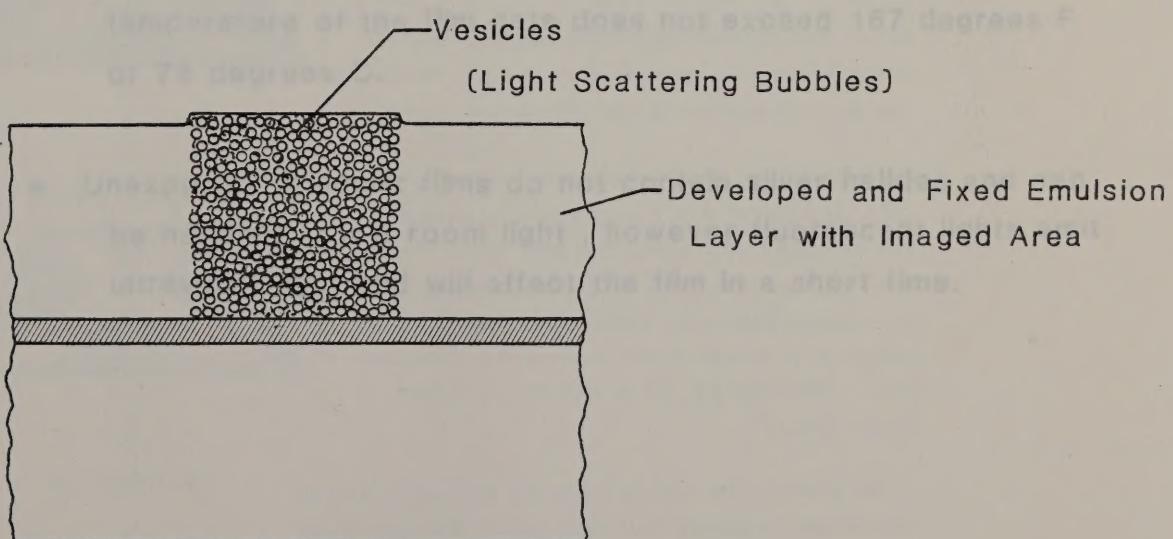


GENERAL STRUCTURE OF VESICULAR FILM (Reverse Polarity)

VESICULAR FILMS (Duplicating Film)



DEVELOPED AND FIXED VESICULAR FILM (Thermal Processing)

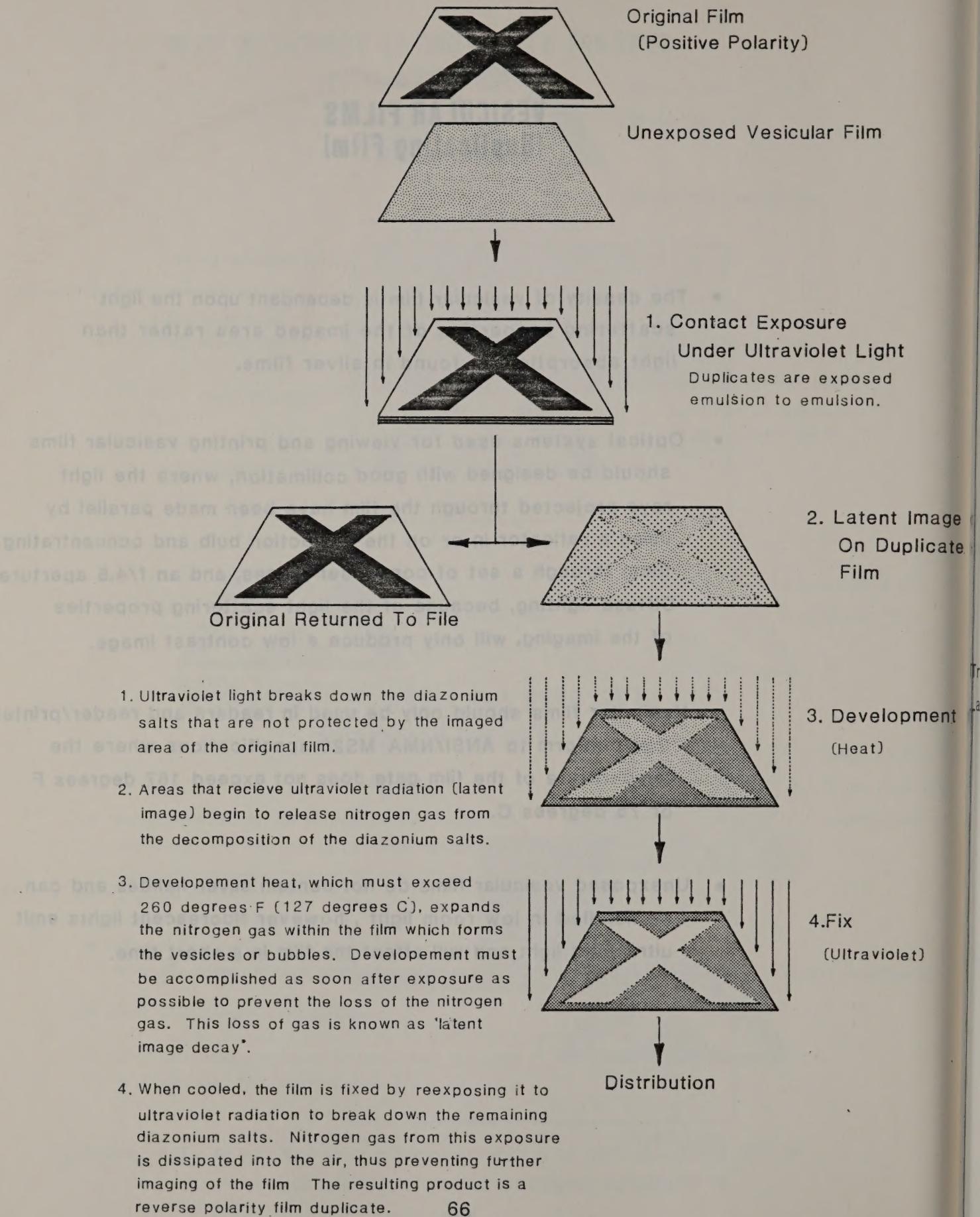


NOTE: Vesicular film is a sign-reversing process, or in other words, it produces negative appearing images.

VESICULAR FILMS (Duplicating Film)

- The density of vesicular film is dependant upon the light scattering properties of the imaged area rather than light absorption as found in silver films.
- Optical systems used for viewing and printing vesicular films should be designed with good collimation, where the light rays projected through the film have been made parallel by using a reflector in or on the projection bulb and concentrating them through a set of condenser lenses, and an f/4.5 aperture. Diffuse lighting, because of the light scattering properties of the imaging, will only produce a low contrast image.
- Vesicular films should only be used in readers and reader/printers that conform to ANSI/NMA MS20 specifications where the temperature of the film gate does not exceed 167 degrees F or 75 degrees C.
- Unexposed vesicular films do not contain silver halides and can be handled in low room light, however fluorescent lights emit ultraviolet light and will affect the film in a short time.

THE VESICULAR PROCESS



ELECTROPHOTOGRAPHIC FILM

GENERAL STRUCTURE OF TRANSPARENT ELECTROPHOTOGRAPHIC FILM (TEP Film)

- Use only those duplicators, readers, and reader/printers fitted with the correct filters that will not damage the electrophotographic film surface.
- TEP film should be protected from excessive high temperature and radiant energy to avoid degradation of prospective imaging images.

Photoconductive Film Matrix

which contains Conductive Lacquers

Contact

light exposure

(metallic conductive implant)

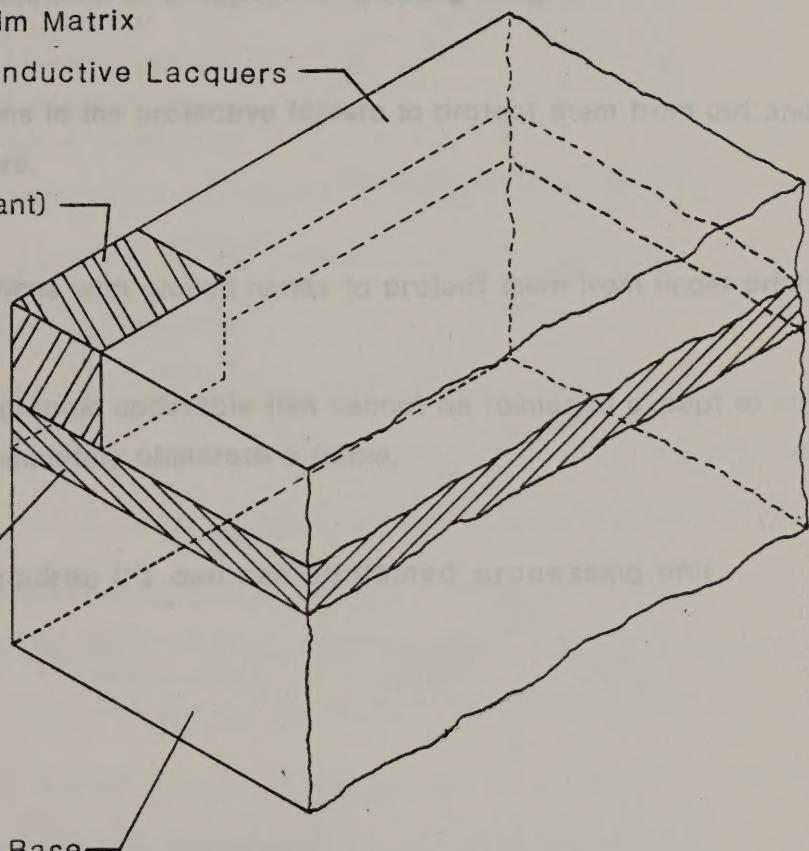
• Handle TEP film carefully to prevent damage to the photoconductive film matrix.

• Electrostatic charges can damage the photoconductive film matrix. Avoid an electrically charged body or clothing when handling TEP film.

transparent Conductive

layer or Grounding Layer

Polyester Base



ELECTROPHOTOGRAPHIC FILM

- Use only those duplicators, readers, and reader/printers fitted with the correct filters that will not damage the electrophotographic film surface.

- TEP film should be protected from excessive high temperature and radiant energy to avoid impairment of prospective updating images.

- Keep TEP films in the protective folders to protect them from dirt and ambient light exposure.

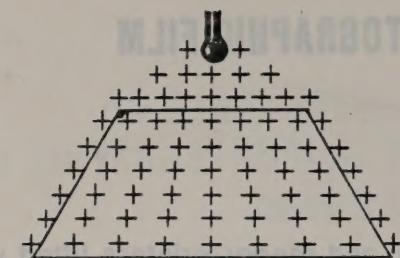
- Handle TEP films with gloved hands to protect them from finger prints.

- Electrophotographic updatable film cannot be reimaged except to void an image or completely obliterate a frame.

- TEP film requires its own self-contained processing unit.

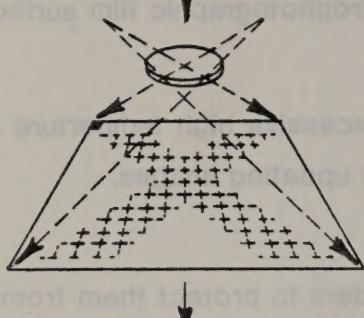
THE ELECTROPHOTOGRAPHIC FILM PROCESS

Updatable Copy Film



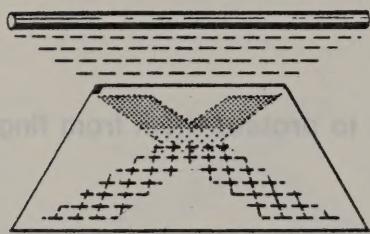
CORONA DISCHARGE

The surface of the film area to be imaged receives an even static charge.



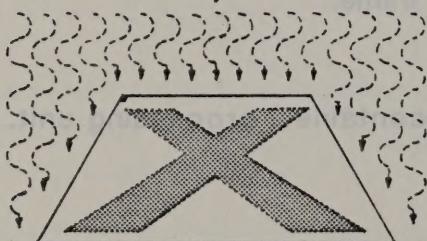
EXPOSURE

The electric charge is absorbed by the grounding layer wherever light from the projected image strikes the film surface. The remaining charged latent film image is therefore the same polarity as the original document image.



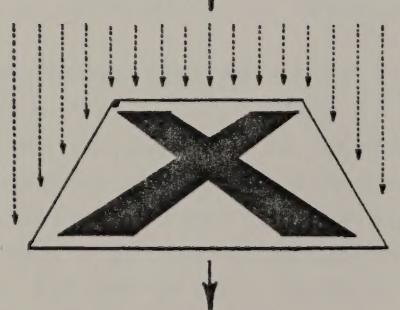
TONER

Oppositely charged toner particles, or beads, are attracted to the electrostatic charge of the latent image.



DRYING

The liquid that carries the toner particles must be evaporated from the toned image before fusing can take place.



FUSING

The toner beads are melted or fused into the surface of the film by applying a controlled heat.

DUPLICATION

PHOTOPLASTIC FILM

Development of photoplastic recording film began in the 1960's and was publically introduced in 1980. Photoplastic recording film must have its own processing system where charging, document exposure, and heat development are controlled within a self-contained unit.

Advantages of this process are high resolution, non chemical dry image development, fast access to the recorded information, storage density equivalent to that of conventional microfilm, and the capability of updating information on previously exposed film.

The latter advantage could be questionable in cases where continuity of record changes would be a deciding factor in determining court actions.

The photoplastic film process begins similarly to the electrophotographic production of images on the TEP film process, where the film is sensitized by Corona discharge. The photo plastic film is then imaged (latent image) by exposure from light projected through a conventional photographic lens. Wherever light strikes the charged film surface, the static electricity is discharged into a conductive layer in the film. It is here that the difference begins. The latent image, or charge pattern, is developed by momentarily heating the photoplastic layer to its flow temperature. Electrostatic forces, corresponding to the changes on the film surface,

produce light-scattering depressions or deformations which become a positive polarity film image when it is cooled. Since the image is "frozen" in the cooled plastic, no other fixing is required.

A sufficiently high heat input will completely erase any selected image, allowing the film to be reused as a master. Each frame may be erased and reimaged up to 10 times.

THERMALLY PROCESSED SILVER FILM

(Dry Silver Film)

Thermally processed silver (TPS) film is a technical advancement of the process first introduced during the mid 1960's in reader/printers where by dry silver prints were produced on paper. The application of TPS processing to film allowed computer output microfilm (COM) units to enter the computer room environment where fast turnaround of microfilm data is a requirement. Because of the residual organic silver compounds left in the film's emulsion, developed TEP film is not desired for archival storage.

The dry silver film process begins when light of the proper wavelengths strikes the coated film. Silver nuclei are created in the silver halide crystals receiving the exposure, while those not exposed remain unchanged. The exposed film now contains a pattern called a latent image which must be amplified or developed by heating it for several seconds. Once the film has

cooled, the developed image can be seen by the eye. No further processing is required because only the exposed organic-silver compounds are affected by heat leaving the unexposed areas relatively unaffected. Dry silver films are sign-reversing or negative polarity.

OVONIC PHOTOSTRUCTURAL RECORDING FILM

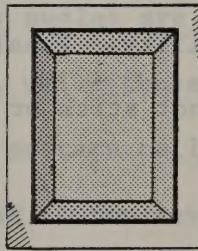
The most recent addition to the market is ovonic film. Ovonics are defined as the application of the change from an electrically nonconducting state to a semi-conducting state exhibited by glasses of special composition (amorphous glass) resulting from application of a certain minimum voltage. The structure of ovonic film is more complicated than most other films. It consists of five very thin layers bonded onto a polyester film base. The first layer applied to the base is an amorphous glass which serves as an adhesion or tie-cast to firmly hold the other layers. The next layer is made of a thin (about one micron) low-melting-point metal alloy or photon-absorbing laminate. This layer is where the image is formed.

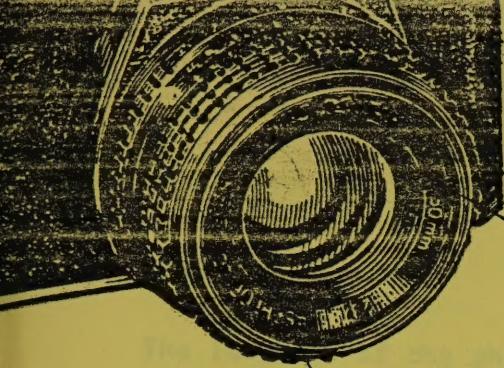
Another layer of amorphous glass is added, both to seal the metallic layer and to bond the next layer which is a polymer overcoat that provides mechanical durability and environmental stability. Finally, a silicone-release polymer is applied so that the film will not stick or jam during processing.

Ovonic film is processed dry, in its own self-contained photographic/processing unit, and uses a two-film image transfer approach (which adds to the final cost) to obtain a long-term imaged film. The film is updatable and is not affected by common room lighting or when used in duplicators. During the time it is being filled with images, it can also be used as a working copy.

The process cycle for ovonic film starts by exposing an image onto dry silver film that is in roll format. The latent image is developed by heat as described earlier for dry silver film. A special platen develops only the imaged area which then is moved into contact (emulsion to emulsion) to a selected frame location on the ovonic microfiche. A Xenon flashlamp pulse of about 1/20,000 of a second is beamed through the imaged dry silver film, which acts as a mask, into the ovonic film. The intensity of the light pulse causes the metal to restructure within the amorphous glass wherever it strikes, altering the optical structure by melting the metal in proportion to the amount of light it receives. Once cooled, the ovonic film needs no further processing. Being that the dry silver film is sign-reversing-(negative polarity), and ovonic film is not, the resultant film master (or working copy) will maintain the negative format of the dry silver image.

You are now ready to push the button!





GLOSSARY OF

The diagram consists of a circle divided into four quadrants by a cross. The top-left quadrant contains terms related to film processing and projection. The top-right quadrant contains terms related to film characteristics and artifacts. The bottom-left quadrant contains terms related to film speed and exposure. The bottom-right quadrant contains terms related to film processing and projection. The center of the circle features the seal of the U.S. Department of the Interior, Bureau of Land Management, with a bison and the text "U.S. DEPARTMENT OF THE INTERIOR" and "BUREAU OF LAND MANAGEMENT".

PHOTOGRAPHIC TERMS:

- PH
- FOG ACUTY
- PULLDOWN
- AHU
- ISO
- LEADER
- AIIM-NMA
- DENSITY
- BLOWBACK
- COMIC
- HOT SPOT
- REFLECTED LIGHT
- STEP TEST
- REDUCER
- TURBULENCE
- BLEED
- RECIPROCITY
- FILM SPEED
- PHOTOGRAPHIC
- S

PROCESSING AND PROJECTION TERMS:

- LATENT IMAGE
- BURN-IN
- EMULSION
- JACKET
- ABERRATION
- MIRROR IMAGE
- CHIP
- MICROFORM
- TONER
- TARGET
- GRAY SCALE
- PRINT
- SIMPLEX
- FRAME
- PROCESSOR
- DYE-BACK
- FLARE
- CANDLE
- DUPE
- GAMMA
- COM
- DUPE
- BLowBACK
- COMIC
- HOT SPOT
- REFLECTED LIGHT
- STEP TEST
- REDUCER
- TURBULENCE
- BLEED
- RECIPROCITY
- FILM SPEED

PHOTOGRAPHIC AND PHOTOMICROGRAPHIC TERMS

image file is positioned directly into the new enhancement unit, and uses a modulating laser beam for exposure to the image file. The image file may be affected by common room lighting or when held up to a light source being illuminated.

GLOSSARY

The following terms are used throughout this book to describe the various types of film used in the photographic process. All terms are defined in the following sections.

negative: The negative image is produced by exposing an image onto dry silver halide film that is in roll form. The latent image is developed by hand as described earlier for dry plate film processing. When developed, the image area measures an 18 mm wide square frame. This frame is reduced to a selected area, known as the **negative image area**. A beam splitter made of glass and mirrors reflects a rayed beam through the original dry silver film, which reflects it upwards into the main film. The intensity of the light rays passes through the negative image area and through glass windows to already filtering the optical system by having the light in proportion to the negative image area removed. Once again, the image film needs no further processing. Using this one dry silver film is a great saving in negative processing cost. As with film layout, the negative film sector for working areas will maintain the negative frame of the dry silver image.

Now you are now ready to push the button!



PHOTOGRAPHIC
AND
PHOTOMICROGRAPHIC
TERMS



1276 MICROFILM

Glossary of Micrographics Terms

Microfilm: A series of successive frames of microfilm.

The language of the photographer and microfilmer contained in this glossary will provide the beginning microfilm technicians with a communication device and also an educational tool into the photographic technology they must use to understand the technical processes they are performing.

Most definitions are taken from the industry standards in the Glossary of Micrographics by the National Microfilm Association (now known as the Association for Information and Image Management).

It is recommended that each office performing micrographic functions purchase a copy of the Industry standard, as the list provided herein is only partial and was compiled for the purpose of training. The AIIM Glossary may be purchased from:

The Association for Information and Image Management
1100 Wayne Avenue
Silver Springs, MD 20910

Industry Standard

Glossary of Micrographics
Order Number T002 1980 Edition

AIIM Member Price \$10.00 prepaid
Non-member Price \$12.00 prepaid

Base—The transparent plastic on which the photographic emulsion is mounted. (See safety film.)

Base Density—the optical density of a film base. Since no plastic is 100 percent transparent, all films have some base density. The base density does not include any density produced by the emulsion layer.

Binding Margin—the combined marginal space formed by the two inner margins of consecutive pages of a book.

Bleed Through (Show Through)—the undesired appearance of information from the back of a document when the front is photographed.

Blowback—the enlargement.

Blow-up—(1) Test—a enlarger; (2) blow = blowback. (See enlargements.)

Blue-sensitive—a term applied to film and paper which are sensitive principally to blue and ultraviolet light and have little or no sensitivity to light of other wavelengths.

Blurred—not sharp or distinct; any indistinct or double-outlined image is said to be blurred.

Glossary

Acetate Film (Acetate Base)--Safety film composed principally of cellulose acetate or triacetate.

AIIM--Association for Information and Image Management. (Formerly NMA).

ANSI--American National Standards Institute.

Aperture--The effective area through which a light beam can enter the camera after passing through the lens.

Aperture Card--A light pasteboard card provided with an opening or openings in which microfilm chips are mounted.

Archival Quality--The ability of a processing print or film to permanently retain its original characteristics. The ability to resist deterioration. See also ANSI PH1.43.

ASA Film Speed or Rating--See ISO Rating.

Background--The portion of a document drawing or microfilm image that does not have line work, lettering, or other information.

Background Density--The opacity of the noninformation area of an image.

Backlighting--Illumination that originates behind the subject and provides transillumination.

Base, Film--The transparent plastic on which the photographic emulsion is coated. (See safety film.)

Base Density--The optical density of a film base. Since no plastic is 100 percent transparent, all films have some base density. The base density does not include any density produced by the emulsion layer.

Binding Shadow--The combined marginal space formed by the two inner margins of confronting pages of a book.

Bleed Through (Show Through)--The undesired appearance of information from the back of a document when its front is photographed.

Blowback--See enlargement.

Blow-up--(1) Verb - to enlarge; (2) Noun - blowback. (See enlargement.)

Blue-sensitive--A term applied to film and paper which are sensitive principally to blue and ultraviolet light and have little or no sensitivity to light of other wavelengths.

Blurred--Not sharp or distinct; any indistinct or double-outlined image is said to be blurred.

Camera--A photographic device, employing an optical system, used for exposing light sensitive material.

Camera Card--(1) An aperture card containing unexposed and unprocessed microfilm in an aperture in the card and which is to be exposed and processed while in the aperture of the card for the purpose of creating an image on the microfilm from a document. (2) The unexposed and unprocessed card input of a processor-camera.

Camera Head--The portion of a microfilming machine which embodies the film, film advance mechanism, and the lens. In planetary type machines, the camera head contains the shutter. In most rotary machines, there is no shutter, since exposures are made by intermittent illumination actuated by the document moving through the machine.

Camera Microfilm--First-generation film; also called the master film or camera-negative film.

Camera, Planetary (Flat-Bed)--A type of microfilm camera in which the document being photographed and the film remain in a stationary position during the exposure. The document is on a plane surface at time of filming.

Camera-processor--See processor-camera.

Camera, rotary (Flow)--A type of microfilm camera that photographs documents while they are being moved by some form of transport mechanism. The document transport mechanism is connected to a film transport mechanism, and the film also moves during exposure so there is no relative movement between the film and the image of the document.

Camera, step and repeat--A type of microfilm camera which can expose a series of separate images on an area of film according to a predetermined format, usually in orderly rows and columns.

Card-to-Card Printer--A device for bringing together and holding a processed microform (image card, jacket, microfiche) in contact with an unexposed microform, while making a light exposure through the first onto the second, thus resulting in a reproduction. See also NMA MS23.

Cartridge--A container enclosing processed microforms, designed to be inserted into readers, reader-printers, and retrieval devices; used with a single core for roll microfilm.

Cassette--A double core container enclosing processed roll microfilm designed to be inserted into readers, reader-printers, and retrieval devices.

Chip--A unit of microfilm containing a micro image or images and coded identification. Chips are usually used in automatic retrieval systems and are most often 35mm in width by three inches in length.

Cinching - Cinch Marks--Pulling film tight when wound on a reel. This generally results in a series of straight, longitudinal scratches ranging from a fraction of an inch to several inches in length.

Cine-oriented Images (A orientation)--Images placed on microfilm in the same mode as frames on motion picture film.

Clarity--Readability or sharpness of detail.

Clearing--(1) A term applied to the removal of silver halides from developed films in the fixer. The film is said to be cleared when no visible unchanged silver halides remain in the emulsion, although about 5 percent of the silver halide usually remains at this point. (2) Treatment of a developed negative, or print in a chemical reducer to remove unwanted density.

Coating--A thin layer which is applied to a base material.

Coating, protective--A thin, transparent coating which is applied to processed microfilm to protect the film from scratches, fingerprints, perspiration, etc.

Collimate--To make rays of light parallel.

COM--(1) Computer Output Microfilm: Microfilm containing data produced by a recorder from computer generated electrical signals. (2) Computer Output Microfilmer: A recorder which converts data from a computer into human readable language and records it on microfilm. (3) Computer Output Microfilming: A method of converting data from a computer into human readable language onto microfilm.

Comic-oriented Images (B orientation)--Images placed on microfilm in the same mode as illustrations in comic strips.

Constant Voltage Transformer (CVT)--An electrical device which maintains constant voltage output, though input voltage may vary. It is frequently used with cameras and measuring instruments.

Contact Print--A print produced by exposure of the unexposed stock in immediate contact with a master or intermediate.

Contact Printing--A method of printing in which the unexposed stock is held in direct contact with the master or intermediate bearing the image to be copied.

Container--A generic term for boxes, capsules, cartridges, magazines, and cassettes or other structures for enclosing microforms.

Contrast--(1) An expression of the relationship between the high and low brightness of a subject or between the high and low density of a photographic image. (2) The rate of density change or the density change per unit exposure. A photographic image is said to have high contrast if the difference between the maximum and minimum density is great. Sensitized materials are graded from "hard" (high contrast) to "soft" in accordance with their inherent contrast characteristics.

Conventional Processing--Conventional processing of silver halide films denoting a processing sequence of development, fix (or monobath), wash, and dry. For diazo film, it denotes processing in an alkaline (ammonia)

environment. For vesicular and dry silver films it denotes processing by heat.

Copy--(1) Noun - Duplicate (deprecated in that sense). The product obtained from reproducing an original. (2) Verb - To reproduce an original by hand or by machine.

Copy, macroscopic--Copy with information large enough to be read without magnification.

Copyboard--A flat, level structure used to support documents in the photographic field.

Copyholder--Any device, such as a spring or arm, that is used to prevent movement of material being photographed.

Core--(1) The center portion of a reel, spool, cartridge, magazine or cassette. A cassette has two cores. (2) An unflanged, cylindrical form on which film or paper is wound. See American National Standard PH1.13.

Corner Cut--On aperture cards and microfiche, a diagonal cut at the corner of a card as a means of identification of the photosensitive side of the film.

Counter--An automatic device which records the use or output of a machine, i.e., in a camera the device which indicates the number of exposures made.

Curvature of Field--The aberration of a lens which causes the image of a plane to be focused into a curved surface instead of into a flat plane.

Darkroom--A room which is used for loading, unloading and the developing of exposed photographic film or paper.

Darkroom Loading--A term used to designate sensitized materials which must be loaded under darkroom conditions.

Daylight Loading--A term used to designate dye-backed film, paper-backed film, or film provided with opaque leader and trailer film in a magazine which may be inserted in and removed from a camera outside a darkroom without incurring unwanted exposure.

Dense--Very opaque, generally applied to film images.

Densitometer--A device used to measure the optical density of an image or base by measuring the amount of incident light reflected or transmitted.

Density (D)--The light-absorbing or light-reflecting characteristics of a photographic image, filter, etc. Density is the logarithm to the base of 10 of the ratio of the radiant energy (light) falling on a sample and the radiant energy transmitted or reflected. Density is expressed as $D = \log \frac{I}{I_t}$ (where I is the radiant energy that falls on the sample and I_t is the radiant energy that is transmitted). In practice, there are many types of density depending on the optical system used (geometric) and on the spectral quality (color) of the radiant energy (light). See also ANSI PH2.17 and ANSI PH2.19.

Density, background--The opacity of the non-information area of an image. (See density, optical.)

Density, diffuse transmission--Diffuse transmission density is expressed as the common logarithm of the ratio of the radiant flux striking the sample (perpendicular to its surface) to the radiant flux transmitted by the sample when all the transmitted flux is collected and equally evaluated, i.e., all the emerging rays have the same effect on the receiver regardless of the angle at which they emerge.

Density, line--The opacity of the line work, letters, or other non-background information of an image. (See density, optical.)

Density, maximum (d-max)--(1) The density of an unexposed diazo material after complete development. (2) The density of a silver halide material attained by complete exposure and complete development.

Density, minimum (d-min)--The lowest density obtainable in a processed film. (See burn-out.)

Depth of Field--The distance between the points nearest and farthest from the camera which are acceptably sharp, at a given lens setting.

Depth of Focus--The allowable tolerance in lens-to-film distance within which an acceptably sharp image of the subject focused upon can be obtained.

Develop--To subject to the action of chemical agents or physical agents (as in xerography) for the purpose of bringing to view the invisible or latent image produced by the action of light on a sensitized surface.

Developer--(1) A chemical reagent used to produce a visible image on an exposed photographic layer. It may take many forms for different materials, such as conventional formulae for silver emulsions, plain water used to develop blueprints; or a gas, such as ammonia vapor used to develop diazo films and prints. (2) A physical material, or mixture of physical materials used to develop a latent xerographic image.

Diaphragm--A device, such as a perforated plate or iris, which limits either the aperture of a lens, the field covered by the lens, or both, depending upon its location.

Diazo Material--A slow print film or paper, sensitized by means of diazonium salts, which subsequent to exposure to light strong in the blue to ultraviolet spectrum and development forms an image. Diazo material generally produces nonreversible images, i.e., a positive image will produce a positive image and a negative image will produce a negative image.

Diffused Light--Scattered, nonparallel light rays either transmitted or reflected. The diffusion may result from such causes as reflection from a matte surface or transmission through frosted or opal glass, or through an integrating bar.

Diffused Light Source--Any light source which is intended to produce nonparallel rays of light. A frosted lamp is a typical diffused light source.

Dimensional Stability--A term applied to the relative ability of photographic materials to maintain their original size and shape, during and after processing, and also under various conditions of temperature and humidity.

Direct Image Film--A film that will retain the same polarity as the previous generation or the original material; that is, tone for tone, black for black, white for white, negative for negative, or positive for positive with conventional procession. (See polarity.)

Direct Negative--See direct image film.

Direct Positive--See direct image film.

Direct Reading--See right reading.

Distribution Copies--Microfilm copies, usually second or third generation, produced from camera microfilm or intermediates for distribution to points of use.

Document--(1) A medium and the data recorded on it for human use, for example, a report sheet, a book. (2) By extension, any record that has permanence and can be read by man or machine.

Drawing--(1) An original pencil, ink, or typewritten line and/or lettered representation which is drawn on a suitable transparent or translucent material. (2) A reproduced tracing.

Dryer--Apparatus for removing moisture from photographic material.

Dry Silver Film--A non-gelatin silver film which is developed by application of heat.

Duo--A term used to define an image positioning technique in rotary camera microfilming. One half of the film is masked and images are photographed along the exposed half of the film. When the full length of film has passed through the camera, it is reloaded so that a second series of images is photographed on the side previously left unexposed. See American National Standard PH5.3.

Dupe--See Duplicate.

Duplex--(1) Photographic paper having emulsion coating on both sides. (2) A term used to define an image-positioning technique in rotary camera microfilming. Through the use of mirrors or prisms, an image of the front side of a document is photographed on one half of the film while an image of the back side of the same document is photographed simultaneously on the other half of the film. See American National Standard PH5.3. (3) A term applied to any camera capable of performing duplex work as described in (2) above.

Duplicate--(1) Noun - In microcopying, a copy usually made by contact printing from a master or an intermediate. (2) Verb - To make multiple copies of a document, usually with the aid of a master.

Duplicate Microfilm Card (exposed)--An aperture card containing an exposed and developed frame of microfilm in the card aperture and which is made from first or later generation microfilm.

Dye-back Film--Any film having a light-absorbing dye coating on the base side of the film to improve daylight loading characteristics and to reduce halation. The dye must be removed during processing.

Easel--A device for holding sensitized material while photographic enlargements are being exposed by means of a projection printer.

Edge Printing--The exposure of a latent image on the edge of a film, outside the normal image area, usually by the film manufacturer. The edge printing may identify the manufacturer, show that the film has a safety base and that the base meets archival standards of permanence.

Electrostatic Process--See xerography.

Emulsion--A single or multi-layered coating of gelatinous material on a transparent base carrying radiant energy reactive chemicals that create a latent image upon exposure. Processing techniques produce a final, visible, useable image.

Emulsion Numbers--Numbers used by photographic film and paper manufacturers to identify coating data.

Enlarge (verb)--To reproduce, using projection printing, larger than the original or the intermediate.

Enlargement--A reproduction larger than the original or the intermediate.

Enlargement Ratio--The ratio of the linear measurement of a microimage of a document to the linear measurement of the enlarged image, expressed as 20X, 30X, etc.

Enlarger--A device for projecting a microimage enlarged onto sensitized material.

Enlarger-printer--A machine which projects an enlarged image from microfilm, develops, and fixes the image on a suitable material.

Enlarging--The process of making enlargements.

Exhaustion--The state of depletion reached by a processing solution due to age or use which makes it incapable of producing satisfactory results.

Expiration Date--A date placed on sensitized photographic material packages by the manufacturers to limit the period during which it is warranted to produce normal results if stored under recommended conditions.

Exposure--(1) The act of exposing a light sensitive material to a light source. (2) A section of a film containing an individual image, as a roll containing six exposures. (3) The time during which a sensitive surface is

exposed, as an exposure of two seconds. (4) The product of light intensity and the time during which it acts on the photosensitive material.

Exposure Meter--An instrument for measuring the light falling upon or being reflected from a subject from which lens and shutter settings can be derived.

Fading--(1) Loss in density of photographic images. (2) The process or result of the process by which fixed graphic images are scanned, transmitted electronically, and reproduced either locally or remotely.

Fiche--See microfiche.

Field--(1) The area covered or "seen" by the lens of a camera. Also see card field and card subfield.

Film--Any sheet or strip of transparent plastic coated with a light-sensitive emulsion.

Film Advance--(1) The movement of film across the exposure area of a camera in regular increments for successive frames. (2) The length of film moved after a given exposure. (See pull-down.)

Film, base--See base, film.

Film, heat-developing--A type of film in which the image is developed by heat.

Film, master--The camera microfilm. It is also known as the original film.

Film, nonperforated--Roll film which does not have sprocket holes or perforations.

Film, nonreversing (direct positive)--Film which does not change from positive to negative images or vice versa in successive generations, for example, diazo film.

Film, orthochromatic (ortho)--A black and white film coated with an emulsion which is sensitive to ultraviolet, violet, blue and green radiation. Not being sensitive to red, red objects photographed with orthochromatic film are rendered dark on a print.

Film, panchromatic (pan)--A black and white film coated with an emulsion which is sensitive to the visual spectrum. The spectral sensitivity of panchromatic films approach that of the human eye.

Film, perforated--Roll film having sprocket holes accurately located along one or both edges to aid in transporting and positioning the film for successive exposures in a camera.

Film, print--A film copy reproduced usually by contact from another film.

Film, processed--Film which has been exposed to suitable radiation and has been treated to produce a fixed or stabilized visible image.

Film, reversal--A film which after exposure is specially processed to produce a positive image instead of the customary negative image.

Film, safety--That film which does not readily support combustion and which meets the American National Standard for safety film, PH1.25.

Film, sheet--A precut rectangle (not in roll form) of flexible transparent base material coated with a photosensitive emulsion.

Film, silver--A film which is coated with a silver halide emulsion.

Film, size--Film width, generally expressed in millimeters, e.g., 16mm.

Film, speed--An expression of the sensitivity of a film to light, usually expressed in ISO units, e.g., ISO 32.

Film, strip--A short strip of processed photographic film, usually 16 or 35 mm, containing a number of frames. (As opposed to a roll, aperture card, or microfiche.)

Film, unitized--The separation of a roll of microfilm into individual frames or strips and insertion in a carrier.

Finder light--A light beam projected from the camera to show the outline of the photographic field.

Fine-grain--(1) Descriptive of film emulsions in which the grain size is small. The term is relative as there is a wide variation in grain size among various fine-grain films. (2) A photographic developer which produces negatives with little graininess.

First Generation Image--The picture of a document, generally used as a master, produced directly by the camera.

First Reproduction Microfilm--Microfilm made from the camera microfilm. It is also called second generation microfilm. (See camera microfilm and generation.)

Fixed Focus--The term applied to optical instruments and photographic equipment which are not provided with a means for varying the focus.

Fixer--A solution used to remove undeveloped silver halides from photosensitized emulsions. The fixer usually contains sodium or ammonium thiosulfate (hypo), a hardening agent, and an acid or acid salt.

Fixing--The part of photographic processing which dissolves the undeveloped silver halides from a processed film or print to render the developed image more permanent.

Flare--Non-image forming, scattered light which results from reflections at optical surfaces, the walls of the camera, or imperfections in the optical parts. If it reaches the image plane it produces density in the exposed area which degrades the photographic quality of the resulting record.

Flat-bed Camera--See camera, planetary.

Flatness of Field--(1) In optics, the characteristics of a lens which produces equal sharpness over the entire image area. (2) In copy work, the accuracy of a plane intended to be perpendicular to the axis of a lens.

Flats--A term used to describe two pieces of glass, polished to a high degree of smoothness and flatness used to hold film in readers and enlargers.

Flow Camera--See camera, rotary.

"f" Number ("f" Stop)--The "f" number for a given lens aperture is derived as follows:

$$\text{"f" number} = \frac{\text{focal length}}{\text{diameter of entrance pupil}}$$

Focal Length--The distance from the back nodal point of a lens to the image plane when the lens is focused at infinity.

Focal Plane--The surface (plane) on which an axial image transmitted by a lens is brought to sharpest focus; the surface occupied by the light-sensitive film or plate in a camera.

Focal Point--A point at which converging rays of light from a lens meet.

Focus--(1) The plane in which rays of light reflected from a subject converge to form a sharp image of the original after passing through different parts of a lens. (2) To adjust relative positions of the lens and film to obtain the sharpest possible image.

Focusing, scale--A calibrated scale which indicates appropriate lens to image positions for given lens to object distances.

Fog--Nonimage photographic density. The defect is due to the action of stray light, improperly compounded processing solutions, or wrongly stored or outdated photographic materials.

Frame (Film Frame)--The area of a photographic film exposed to light in a camera during one exposure, regardless of whether or not this area is filled by the document image.

Frame, microfiche--(1) One microimage and margin contained within a film frame. (See margin.) (2) A single area of a grid pattern.

Fuzziness--Lack of image sharpness caused by a defective or dirty lens, poor focus, movement, etc.

Fuzzy--The appearance of an image that lacks sharpness.

Gate, film--The aperture unit in a camera, printer or reader in which the film is held at a fixed relationship to a lens.

Generation--A measure of the remoteness of a particular copy from the original material. The picture taken of a document, cathode ray tube, etc., is termed first generation microfilm (camera microfilm). Copies made from

this generation are second generation, and copies from the second generation are third generation, etc. First generation negative appearing microfilm is designated 1N and second generation positive appearing microfilm is designated 2P, etc. (See-- negative appearing image, positive appearing image.)

Generation, even--The second, fourth, sixth, etc., generations are even.

Generation, odd--The first, third, fifth, etc., generations are odd.

Grain--(1) The discrete particles of image silver in photographs. The random distribution of these particles in an area of uniform exposure gives rise to the appearance of clumping known as "graininess." (2) The direction of transport in the paper making machine which usually curls more with the grain than "against" or across the grain.

Graininess--(1) The subjective impression of nonuniformity in an area of a photograph corresponding to uniform exposure most often noticeable in enlargements with a magnification of ten or more. (2) A defect in a diazoprint which is characterized by poor uniformity of color distribution, more or less in the pattern of small dots or grains.

Grain Size--A measure of the fineness of grains of silver halide in an emulsion. Microfilm has a very fine inherent grain size. Grain size is affected by the conditions of exposure and processing.

Graphic-- Of, or pertaining to, data in the form of pictorial communications, as for example, drawings, charts, engineering design, and plotted data.

Gray Scale--See scale, gray.

Grid, microfiche--A defined array of horizontal and vertical lines which divide an area into uniform spaces called frames. The grid defines the arrangement of the rows and columns of microimages.

Gross Density--The total density of film including base density, image density, and fog. (See base density, density, and fog.)

Halation--A halo ghost image or fog caused by reflection of rays of light from the base to the emulsion or by internal scattering of light within the film.

Halide--Any compound of chlorine, iodine, bromine, or fluorine, and another element. Silver bromide, silver chloride, and silver iodide are the light sensitive materials in silver emulsions.

Hand Viewer--A small, portable magnifying device used for viewing microfilm. Magnification generally ranges from 5X to 15X.

Hard Copy--An enlarged copy usually on paper.

High Contrast--A term expressing a relationship of image tones in which lines and background are represented by extreme differences of density.

High Reduction (hr)--Reductions above 30X up to and inclusive of 60X.

High Reduction Fiche--Microfiche with images reduced more than 30X up to and inclusive of 60X. (See microfiche, high reduction, ultra high reduction, ultrafiche.)

Hollerith--Binary coded information representing alphanumeric or special characters. Normally, Hollerith is used to denote characters punched in standard eighty-column EAM cards.

Hot Spot--An area of obviously greater brightness than the surrounding area; e.g., the central portion of an unevenly illuminated reader screen.

Humidity--The degree of wetness of the atmosphere. Absolute humidity. The weight of water vapor contained in a given volume of air, as grains per cubic foot.

Humidity, relative--The amount of water vapor present in the atmosphere expressed as a percentage of the amount required for saturation at a given temperature.

Hygrometer--An instrument for measuring relative humidity.

Hypo--Ammonium or sodium thiosulfate. The agent used to remove unexposed silver halides from silver emulsion film. The term is generally used to refer to a fixer solution which may contain also certain acids and/or hardening agents.

Hypo, residual--The amount of ammonium or sodium thiosulfate (fixer) that remains in film or paper after washing.

Hypo Clearing Agent--See hypo eliminator.

Hypo Eliminator--A chemical solution which assists in the removal of hypo from film or prints.

Hypo Test--A method of checking the amount of residual hypo remaining in a film or print after washing. (See residual thiosulfate test.)

Illimination--See light, terms of.

Image--A representation of an object such as a document or other information sources produced by light rays.

Image, latent--The invisible image produced by the action of radiant energy on a photosensitive surface. It may be made visible by the process of development.

Image, latent electrostatic--The electrostatic charge pattern remaining on a photoconductor after exposure to radiant energy, or created on an insulating medium by electrostatic techniques. It may be made visible by the process of xerographic development.

Image, negative--A photographic image in which the values of light and dark of the original subject are inverted. In a negative, light objects are represented by high densities and dark objects are represented by low densities.

Image, positive--A photographic image in which the values of light and dark of the original subject are represented in their natural order. In a positive, light objects are represented by low densities and dark objects are represented by high densities.

Image Area--Part of the recording area reserved for the image.

Image Density--The density of the information of an image. (See density, line.)

Image Mark Retrieval Code--A document mark (blip) associated with an image used to count and locate images automatically.

Image Orientation--The arrangement of objects or images with respect to the edges of the film.

Image Reversing Film--A film handled with conventional processing that will reverse the polarity and tonal scale of the previous generation or the original material; that is, whites from blacks, blacks from whites, negatives from positives, and positives from negatives. (See direct image film, polarity.)

Image Spacing--The distance between frames.

Incandescent--Glowing with heat and giving off visible radiation, such as the tungsten filament in an incandescent lamp.

Incident--The act of falling upon or affecting, as light upon a surface.

Indexing Film--A system using targets, flash cards, lines, or bars, etc., for locating information appearing on a reel of microfilm. It enables rapid location of the section of film which contains the desired image on the reel without the necessity of examining each image sequentially.

Information Area--The area of a document which contains information usually exclusive of the margin.

Infrared--Pertaining to or designating those rays which lie just beyond the red end of the visible spectrum, such as are emitted by a hot body. They are invisible and are detected by their thermal, photoelectric, and photographic effects. Their wavelengths are longer than those of visible light and shorter than those of radio waves.

Input--(1) The means for supplying information to a machine. (2) The path through which information is applied to any device.

Insert, film--A microfilm strip cut in lengths to fit a jacket or film holder, or for stripping up a master microfiche.

Intermediate--A microfilm or other reproducible used to make distribution copies; microfilm intermediates are usually made from camera microfilm.

ISO--International Standards Organization.

ISO Rating--Units of expression of the sensitivity of a film to light. (See film speed.)

Jacket--A transparent plastic carrier with a single or multiple sleeve or pocket made to hold microfilm in flat strips.

Jacket Face--The front of the jacket (index readable side).

Jacket Rib--The thin narrow plastic strips which separate acetate sheets, thereby forming the sleeves or pockets.

Lamp--A generic term for an artificial source of light.

Lamp, prefocus--A light bulb whose filaments are precisely positioned with respect to the lamp base.

Latent Image--See image, latent.

Leader--Film at the beginning of a roll which is used for the threading of a camera, projector, and processing machine.

Legend--A caption, title, or brief description.

Legible--Information that is readable, understandable, and usable. (See contrast.)

Lens--In photography, the optical instrument or arrangement of light refracting elements designed to collect and distribute rays of light in the formation of an image.

Lens Flare--See flare.

Lens Stop--Aperture setting of a lens.

Lens Tissue--A grit-free, lintless paper specially prepared for cleaning the surfaces of lenses and other optical elements.

Light (Visual)--The aspect of radiant energy of which a human observer is aware through the visual sensations which arise from the stimulation of the retina of the eye.

Light, ambient--Surrounding light; the general room illumination or light level.

Light, black--A term applied to radiant energy lying outside the visible range, especially in the near ultraviolet region of the spectrum and which is converted to visible light by the action of suitable fluorescent materials.

Light, incident--The light which strikes an object, distinguished from the light absorbed by, reflected from, or transmitted by the object.

Light, white--Radiation having a spectral energy distribution that produces the same color sensation to the average human eye as average noon sunlight.

Light Meter--An instrument which measures and indicates intensity of incident, reflected, and/or transmitted light.

Light-sensitive--Materials which undergo changes when exposed to light. The commonly used photographic light-sensitive materials used in films and papers are the silver halides, diazo dyes, biochromated gelatin, and the photoconductive materials used in xerography.

Lines Per Millimeter (mm)--See resolution.

Low Reduction (lr)--Reductions up to and inclusive of 15X.

Macroscopic--Large enough to be read without magnification, e.g., titles on microfiche.

Magazine--(1) A light tight container which protects sensitized material and facilitates loading and unloading a camera, printer or processor; used with a single core for roll microfilm. (2) (deprecated) A container enclosing processed microforms usually roll microfilm, designed to be inserted into readers, reader-printers and retrieval devices; used with a single core for roll microfilm.

Magnification--The linear ratio of the size of the image to that of the object when viewed through or projected by an optical instrument.

Magnification Range--The linear range or span of magnification in a given optical system which is usually expressed in diameters or times, i.e., magnification range 12X through 24X.

Margin (drawings)--(1) On drawings, the area of the drawing beyond the line enclosing the information area. (2) On a film frame, the area of background between the edge of the drawing and the edge of the film frame is sometimes called margin.

Mask--(1) An opaque material used to prevent exposure of certain areas, usually the border of a picture. (2) Any material used to provide a border of desired color, white or black, around an image.

Master--A copy of a document, or in some processes the original itself, from which copies can be made.

Master Film--Any film, but generally the camera microfilm, used to produce further reproductions, as intermediates or distribution copies.

Master Microfilm Card--An aperture card containing microfilm, generally a negative, which is used for producing further reproductions.

Measuring Magnifier--A magnifier with a scale in the object plane used for measurement and comparison purposes.

Medium Reduction (mr)--Reductions above 15X up to and inclusive of 30X.

Microcopying - Microphotography--(deprecated in this sense) - The application of photographic processes to produce copies in sizes too small to be read without magnification.

Microfiche--A sheet of microfilm containing multiple microimages in a grid pattern. It usually contains a title which can be read without magnification.

Microfilm--(1) A fine-grain, high resolution film containing an image greatly reduced in size from the original. (2) The recording of microphotographs on film. (3) Raw film with characteristics as in (1).

Microform--A generic term for any form, either film or paper, which contains microimages.

Micrographics--Micrographics is the industry which reduces any form of information to a microform medium. (See microform.)

Microimage--A unit of information, such as a page of text or a drawing, too small to be read without magnification.

Micro-opaque--A sheet of opaque material bearing one or more microimages.

Microphotography--The application of photographic processes to produce copy in sizes too small to be read without magnification. (Not to be confused with photomicrography.)

Mirror Image--See reverse reading.

mr--An abbreviation for medium reduction, above 15X up to and inclusive of 30X.

Multi-frame Document--See sectioning.

NBS--National Bureau of Standards.

NBS Chart--See resolution test pattern.

Negative--See negative appearing image.

Negative Appearing Image--A photographic image with light lines, characters, and neutral tones on a dark background.

NMA--National Microfilm Association. See AIIM.

Opacity--The characteristic of a material which prevents light from passing through it.

Opal (glass, plastic)--A translucent material often used for the copyboard surface of planetary cameras. It acts as a support for the drawing and a diffuser when backlighting is used.

Opaque, micro--See micro-opaque.

Optical Center--A reference location (point) on the film about which the image area is centered with respect to length and width.

Original--The document from which copies are produced.

Orthochromatic (ortho)--See film, orthochromatic.

Over Develop--To permit a photographic image to be developed too much because of one or more of the following factors: (1) Excessive time. (2) Excessive temperature. (3) Overstrength of developer solution. (4) Excessive agitation.

Overexposure--To permit too much exposure of a photographic copy. This may be caused by: (1) Light too brilliant. (2) An aperture too large. (3) Exposure time too long.

Overlap--(1) A defect in which one image or document partially covers and obscures another. In planetary cameras, this is caused by improper pull-down causing the images to overlap. In rotary cameras, overlap is caused by improper setting of the document stop or improper clutch adjustment. (2) On sectionalized, multi-frame documents, the portion of a document which appears again in the succeeding frame for matching purposes.

Panchromatic (pan film)--See film, panchromatic.

Paper, Photographic--A high grade paper base coated on one or both sides with a photosensitive layer or layers.

Perforations--See film, perforated.

Peripheral--Near the boundary or edge of the field of an optical system; the outer fringe.

Permanent Record Film--A photographic material so composed and treated that the image and support will have maximum archival quality under ordinary room storage conditions. See American National Standard PH1.28.

pH--A measure of the acidity or alkalinity of chemical substances expressed as the logarithm of the reciprocal of the hydrogen ion concentration. The pH scale extends from zero to 14. A pH of 7 is approximately neutral. A pH of 6.9 or less is acid. A pH of 7.1 or greater is alkaline.

Photoconductor--(1) A material which is an electrical insulator in darkness but which becomes electrically conductive when exposed to light. (2) A material which will hold an electrical charge in the dark but which is dissipated when illuminated.

Photocopy--A photographic reproduction, excluding microcopy, generally produced by exposing the image of an original or photographic film or paper.

Photocopying--The application of photographic processes to produce copies, excluding microcopies, generally by exposing the image of an original on photographic film or paper.

Photoflood--A lamp designed to yield brilliant diffuse illumination. These lamps generally have a short life.

Photograph--(1) A positive or negative picture obtained by the photographic process involving exposure of a sensitized photographic material in a camera and subsequent processing and printing operations. (2) Any image recorded on photographic sensitized material.

Photographic Emulsion--See emulsion.

Photomacrograph--(1) A photograph of an object, either unmagnified or slightly magnified (the upper limit often being about 10 diameters). (2) A macrography made by photography. (3) A photo image which can be read without magnification.

Photometer--An instrument for measuring the intensity of light, specifically for comparing the relative intensities of light emitted from different sources of illumination.

Photosensitive--Sensitivity to light.

Photostat Copy (negative)--Usually a white line on black background, right reading photographic paper copy of any document made in a Photostat machine, also, white copies made from such black copies.

Placement--See image position.

Planetary Camera--See camera, planetary.

Platen--A mechanical device which holds the film in the focal plane during exposure.

Polarity--A word used to indicate the change or retention of the dark to light relationship of an image, i.e., a first generation negative to a second generation positive indicates a polarity change while a first generation negative to a second generation negative indicates the polarity is retained.

Polyester--Transparent plastic used as a film base because of its transparency, stability and relative non-inflammability.

Positive--See positive appearing image.

Positive Appearing Image--A photographic image with dark lines, character, and neutral tones on a light background.

Precoat--A coating often called "subbing" applied to film and paper to make the photosensitive material adhere to the surface. (See subbing.)

Print Film--A fine grain, high resolution film used primarily for making contact film copies.

Printer--See card-to-card printer, enlarger-printer, or roll-to-roll printer.

Printer, contact--An exposing device containing a light source and a means for holding a film in close contact with the sensitized material on which the print is made.

Printing Density--See density, printing.

Printing Speed--Rate at which a light-sensitive material is exposed, usually expressed in feet per minute of printer operation.

Processing--The treatment of exposed photographic material to make the latent image visible, i.e., a series of steps consisting of developing, fixing, washing, and drying.

Processor--Any machine which performs the various operations necessary to process photographic material.

Processor-Camera--A device which has both the functions of a processor and a camera.

Projection--(1) Formation of an image through optical means onto a sensitized surface or viewing screen, usually in magnified size. (2) An image that is visible after it has been optically projected through space onto a surface.

Projection Printing - Optical Printing (strongly duplicated)--A method of exposing a photosensitive coating by projection of an image through an optical system.

Pull-Down--The length of film advanced after each exposure.

Radian Energy--Energy in the form of an electromagnetic wave, e.g., x-rays, ultraviolet energy, light, infrared energy, radian heat, and radio waves.

Raw Stock--Unexposed, unprocessed sensitized material.

Reader--A projection device for viewing an enlarged microimage with the unaided eye.

Reader-Printer--A machine which combines the functions of a reader and an enlarger-printer.

Reciprocity Law--The Reciprocity Law of Bunsen and Roscoe states that exposure is equal to the intensity (irradiance) of the exposing energy multiplied by the time during which it acts. This law is only approximately followed by photographic materials and deviations from it are known as "Reciprocity Law Failures."

Recording Area--The maximum useful area containing all the recorded information including the image and retrieval codes.

Records Preparation--The process of sorting, flattening, removing fasteners (such as staples and paper clips), and index planning preliminary to microfilming.

Reduction--A measure of the number of times a given linear dimension of an object is reduced when photographed, expressed 16X, 24X, etc.

Reduction, effective--A measure of the number of times an imaginary document would have been reduced to equal the size of the COM generated microimage, expressed as 24X, 30X, etc.

Reduction Ratio--The ratio of the linear measurement of a document to the linear measurement of the image of the same document expressed as 16:1, 20:1, etc.

Reel--A flanged holder on which processed roll film is wound, designed to be inserted into readers, reader-printers, and retrieval devices. See American National Standard pH5.6.

Reference Copies--Microfilm copies, usually of the second or higher generation, made from camera microfilm, intermediates, or distribution copies; reference copies are usually not accountable and are sometimes called "non-returnable" or "throw-away" copies.

Reflected Light--Light which has been deflected from a surface, not having been absorbed.

Refraction--Deviation of a ray of light in passing obliquely from a medium of one density to a medium of another density, as light passing from air into glass or water.

Repeatability--The accuracy with which a system may be made to record successively in the same geometric location within a frame.

Replenisher--A chemical formula which is added to a processing solution to maintain uniform activity.

Reproducible--A document or copy which is sufficiently translucent to be used to make further contact copies.

Reprography--The art and science of reproducing documents.

Residual Thiosulfate (residual hypo)--Ammonium or sodium thiosulfate (hypo) remaining in film or paper after washing. Since residual hypo has a deleterious effect and reduces permanence, careful control must be maintained in processing to ensure that permissible limits are not exceeded. (See archival quality.)

Residual Thiosulfate Test (residual hypo test)--A test method, using mercuric chloride, to measure residual thiosulfate content in films. See American National Standards pH1.28 and pH4.8.

Resolution--The ability of optical systems and photo-materials to render visible fine detail of an object; a measure of sharpness of an image, expressed as the number of lines per millimeter, discernible in an image. Resolution in processed microfilm is a function of film emulsion, exposure, camera lens, camera adjustment, camera vibration, and film processing.

Resolution is measured by examining a microfilmed resolution test chart under a microscope to determine the smallest pattern in which lines can be distinguished both horizontally and vertically. (See resolution test pattern.)

Resolution, Spurious--A false indication of resolution which may result from an out of focus condition. If spurious resolution is suspected, it may be recognized by counting the number of lines in a pattern which appears to be resolved. If there should be five lines and there are less than five the resolution is spurious.

Resolution Test Pattern and Chart--A carefully prepared chart containing a number of increasingly smaller test patterns. The pattern is a set of horizontal and vertical lines of specific size and spacing. The National Bureau of Standards "Microcopy Resolution Chart Number 1010a" is generally used in microfilming work.

Resolvable Horizontal Lines--The maximum number of visually distinguishable horizontal lines which can be recorded within a specified image.

Resolvable Line Pitch--Number of resolvable lines

$$\text{Image dimension (mm)} \quad = \text{lines/mm} \\ \text{perpendicular to the resolvable lines.}$$

Resolvable Vertical Lines--The maximum number of visually distinguishable vertical lines which can be recorded within a specified image.

Resolving Power (photographic)--The degree to which a lens, optical system or film emulsion is able to define the detail of an image, expressed as the number of lines per millimeter, discernible in an image.

Retake--Refilming of documents.

Retrieval System, information--A system for locating and selecting on demand, certain documents, data or other records relevant to given information from a file of material. Examples of information retrieval systems are classification, indexing, and machine searching systems. The term information retrieval system should be used as the generic term that includes reference, document, and fact retrieval systems.

Reverse Reading--A term used to define a reproduction which is a mirror image of the original,

e.g.,

(may be rotated to any position in the same plane).

Rewind--(1) A support, and a device consisting of a spindle geared to a crank, used in pairs to wind film from one reel to another. (2) The act of transferring from one reel to another to obtain a different orientation of the film.

Right Reading--That image which is legible in a normal reading position,

e.g.,

(may be rotated to any position in the same place).

Rinse--To wash off, to cleanse; a liquid bath to remove foreign matter and chemicals.

Roll Microfilm--A length of microfilm on a reel, spool or core.

Roll-to-Roll PrinterAn equipment for producing duplicate rolls of microfilm by contact printing.

Rotary Camera--See camera, rotary.

Safelight--A darkroom light source required to give maximum visual intensity with the least or no effect on photographic materials.

Safety Film--A term designating a comparatively noninflammable film support (base) composed mainly of cellulose esters of acetic, propionic, or butyric acids and which meets American National Standards for safety film. See American National Standard pH1.28. (See base, film.)

Scale, gray--An array of adjacent neutral gray density areas varying by a predetermined rate or stepwise from black to white and used to control the contrast of photographic duplicates. A step tablet or gray wedge. Continuous gradient gray scales, showing no perceptive steps, also are used for special purposes.

Scratch--A linear groove which damages the base or sensitized side of the film and which is usually caused by mechanical means. Scratches in the base generally appear as black lines when observed in a reader, but they have a clear appearance, except for dirt accumulation, when observed with a viewer. Scratches in the emulsion may appear light when viewed on a reader, but may appear dark or clear when viewed with the unaided eye. Dark lines in the emulsion are caused by scratches occurring prior to developing, while clear lines are generally caused by scratches occurring after development.

Screen--A surface onto which an image is projected.

Second (Nth) generation Image--A copy made directly from a first generation image (a N-lth generation image).

Second Reproduction Microfilm--Microfilm made from the "First Reproduction Microfilm" also called 3rd generation microfilm. (See first reproduction and generation.)

Sectioning (sectionalization)--Microfilming of an oversize document in two or more parts.

Sensitivity--The degree to which an emulsion reacts by the formation of a latent image under given exposure conditions, especially as this relates to exposure by different wavelengths (colors) of light.

Sensitize--(1) To treat a photographic layer with a chemical that makes it more photosensitive, or to extend the spectral sensitivity of a photosensitive layer by treating with dyes. (2) To coat a support material with a photographic layer. (3) To establish an electrostatic surface charge of uniform density on a photoconductor.

Sharpness--The degree of line clarity. (See acutance.)

Shelf Life--The period of time before deterioration renders a material unusable.

Shoot--To take a picture.

Short Stop--See stop bath.

Shot--A single exposure or photograph.

Show Through--See bleed through.

Shutter--Any mechanical device which regulates the time that light is permitted to act upon sensitized film or paper.

Shutter Speed--The length of time in which light is permitted to act upon film or paper as a result of the shutter having opened and closed.

Silver Film--See film, silver.

Silver Halide--A compound of silver and one of the following elements known as halogens: chlorine, bromine, iodine, fluorine.

Silver Recovery--The reclamation of silver from spent photographic fixing baths, an economic operation where large volumes of fixing baths are used. The silver may be precipitated by addition of sodium sulfide or zinc dust, or electrolytically deposited on cathodes suspended in the fixing bath. Silver recovery may destroy the photographic properties of the bath.

Slippage--Any relative movement which occurs between negatives and print during exposure on continuous printing equipment which results in loss of resolution, and in extreme cases, fuzziness.

Sludge--A flocculent precipitate which forms in processing tanks during and after use.

Sodium Thiosulfate--See hypo.

Spacing--The distance between the trailing edge of one finished frame and the leading edge of the succeeding finished frame on a roll of microfilm.

Specular--Reflecting in a regular manner, like a mirror, so that clear images may be formed nondiffusing. The meaning is extended to include regular (nondiffusing) transmission as well as reflection.

Speed--A common term for sensitivity of a photographic layer, maximum aperture of an objective lens, chemical efficiency of a processing solution or the timing of a shutter. The "speed" of film is established by American Standard procedures and is generally based on the reciprocal of the exposure required to produce a certain fractional gradient or density.

Spherical Aberration--A lens defect which causes rays parallel to the axis and other than those passing through the axis to come to focus nearer the lens than the rays passing through the center portion.

Spindle--A shaft to fit the hole in a film reel, onto which the reel may be mounted and locked during transport of one reel of film to another.

Splice--A joint made by cementing or welding (heat splice) two pieces of film or paper together so they will function as a single piece when passing through a camera, processing machine, projector or other apparatus. Cemented splices are called lap splices since one piece overlaps the other. Most welds are called butt splices since the two pieces are butted together without any overlap. Some butt splices also use tape.

Splicer--A device for joining strips of photographic film or paper.

Spool--A flanged holder on which unprocessed roll film is wound, designed to be inserted into cameras and processors. It is manufactured to close tolerances so that the film fits snugly within the flanges and keeps edge fog to a minimum. See American National Standards pH1.33, pH1.34, pH1.35, and pH1.36.

Spurious Resolution--See resolution, spurious.

Squeegee--There are three types of squeegee, each designed to remove excess moisture from the surface of film or paper: (1) A blade, like a windshield blade, used for paper prints and on paper processors. (2) A roller, called a print roller, or a pair of rollers as found in continuous paper processors. (3) Air squeegee, used in continuous film processors, which directs a high velocity stream of air against the surfaces of the film.

Step Tablet (step wedge)--A length of film containing gradations of density, which may or may not be calibrated. A calibrated step tablet is used as a standard in the calibration of a densitometer.

Step Test--(1) A series of orderly varied exposures made to determine the optimum exposure of either film or paper prints. (2) To test for contrast or latitude, a step tablet is used in a single exposure.

Step Wedge--See step tablet.

Stock Solution--A concentrated solution which usually is diluted with water or another solution for use under normal working conditions.

Stop "f"--See "f" number.

Stop Bath--A dilute acid solution used to arrest development by neutralizing the alkaline developer with which the photographic material is saturated as it leaves the developing bath.

Storage and Retrieval--See data storage and retrieval; retrieval, information and retrieval, system information.

Streak--A light or dark area through a number of images, parallel to the edges of film.

Stretch--An image defect which is found in films or prints produced on rotary cameras or continuous printers, and which appears as a longitudinal blur.

Subbing--A coating applied to the film base to improve the adherence of the emulsion or sensitized material. (See Precoat.)

Sub-stage Illumination--See back lighting and transilluminator.

Sub-state Illumination--See back lighting and transilluminator.

Take-up-Reel--Any reel onto which processed film or paper is wound.

Target--(1) Any document or chart containing identification information, coding or test charts. (2) An aid to technical or bibliographic control which is photographed on the film preceding or following the document. (Microfilm Norms, ALA.)

Temperature Control--Any device used to maintain the temperature of a solution within certain limits or tolerances.

Test Chart--See resolution test pattern.

Test Frame--A microfilm image of a test target used to check microfilm quality.

Test Patch--A piece of film used for a residual thiosulfate test.

Thermal Diazo--A diazo material which requires only the addition of heat for the formation of the dye line.

Threading--Loading film or leader into a photographic device from the supply spool around all idlers, rollers, sprockets, etc., to the take-up spool.

Timer--(1) A special clock for use in darkrooms which gives audible or visible indication of various time intervals, generally in seconds and minutes. (2) An electric clock which may be set to actuate some other mechanism such as a shutter for a given time interval.

Title--A descriptive identification of the content of the material on the microfilm.

Title Space--The area available for title information on microfiche or micro-opaque cards.

Toner--The material employed to develop a latent xerographic image.

Top Lighting--The method of lighting a document for microfilming where the lights are above the document (as opposed to back lighting).

Trailer--That portion of film beyond the last images recorded.

Transilluminator--A diffuse light source of large area, such as a light box.

Transmission Density--See density.

Transmitted Light--Light which passes through a transparent or translucent material.

Transparency--An image on transparent basestock which may be viewed by transmitted light, or used to make copies.

UHR--An abbreviation for Ultra High Reduction, above 90X.

Ultrafiche--Microfiche with images reduced more than 90X. (See microfiche, ultra high reduction, high reduction.)

Ultraviolet--Pertaining to or designating those radiations which lie beyond the blue end of the visible spectrum, approximately from 2000 to 4000 mm. (2000 to 4000 angstroms.)

Underdevelop--Insufficient development of sensitized material, due to developing for too short a time, use of a weakened developer, or too low a temperature.

Underexposure--Insufficient exposure of sensitized material, due to insufficient illumination, too short an exposure time, or too small a lens aperture.

Unitize--(1) The separation of a roll of microfilm into individual frames and insertion in a carrier. (2) To microfilm on one or more sheets of microfiche a unit of information, such as a report, a specification or a periodical.

Unperforated--See film, nonperforated.

USASI--See ANSI.

UV Range (near)--The ultraviolet portion of the light spectrum immediately below the visual range extending from approximately 3200 to 4000 mm (3200 to 4000 angstroms).

Very High Reduction (vhr)--Reductions above 60X up to and inclusive of 90X.

Vesicular Film--Film which has the light sensitive element suspended in a plastic layer and which upon exposure creates strains within the layer in the form of a latent image. The strains are released and the latent image made visual by heating the plastic layer. The image becomes permanent when the layer cools.

Visual Range--The portion of light spectrum which can be seen by the human eye, which is approximately 4000 to 7000 mm (4000 to 7000 angstroms).

Water Spots--Deformation of photographic gelatin layers on a film due to differential drying when waterdrops stand on the surface and keep the gelatin wet and swollen after the surrounding gelatin has become dried and compressed. The spots have a characteristic appearance when a negative on which they occur is printed. Viscose sponges and wetting solutions (detergents) are commonly used to avoid such defects.

Wetting Agent--A chemical added to water to reduce surface tension, thereby improving wetting characteristics and reducing the formation of waterdrops.

Working Solution--A solution which is of the correct strength for use, and which is frequently made by dilution of a stock solution.

Wrapping Band--A band, usually made of paper, which is wound and secured around a reel of processed film for ease of handling and to protect the film.

Xerography (electrostatic)--A generic term for the formation of a latent electrostatic image by action of light on a photoconducting insulating surface. The latent image may be made visual by a number of methods such as applying charged pigmented powders or liquid which are attracted to the latent image. The particles either directly or by transfer may be applied and fixed to a suitable medium. See Webster's Unabridged Dictionary, Third Edition.

Zirconium Lamp--A special high intensity point source lamp frequently used because of its low emanation of long (heat) wave length light and its concentrated sources.

Zoom Lens--A lens with moveable optical elements which can retain an object in focus while changing the lens focal length. Consequently the size of the object can be varied while the camera or reader remains in the same position.

